VOL. 26 No. 8

BULLETIN
OF THE
TORREY BOTANICAL CLUB

AUGUST 1899

Some Species of Bidens found in the United States and Canada

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Several years ago, while collecting in the vicinity of Ithaca, N. Y., the writer found a number of specimens of *Bidens connata*, on which the awns were upwardly barbed. Until recently * such specimens have been considered to be hybrids with some species of *Coreopsis*, but in the plants in question there were no characters to warrant such an assumption further than the mere fact of the difference in direction of the barbs. It was thought best, therefore, to attempt a study of this group to determine, if possible, the exact affinities of the various forms and the constancy of some of the more important characters. *B. cernua* and *B. laevis*, in Central New York, have also been much confused, mainly, however, because of the presence of the form here distinguished as *B. cernua intermedia*. It was decided on this account to include these two species also in the proposed study.

Since that time a large mass of material has been collected and many field notes have been made from plants growing in various portions of New York State. To supplement this, specimens have been examined from many other localities throughout the United States and portions of Europe and Asia. In September, 1897, the writer was able to separate the *B. connata comosa* Gray as a distinct species, and now the study has reached such a stage as to warrant the publication of all the results.

* Britton, Bull. Torr. Bot. Club, **20**: 280. 1893.

[Issued 17 August.]

The value of the different characters from a taxonomic standpoint has, in general, been found to agree with that placed upon them by previous authors. The most important of all is, of course, the achene, and by this one character alone most of the species may be recognized. Very much dependence cannot be placed upon the leaves, because of the unusually great variation produced by environment, through which influence both the size and the incisions are modified. Two other structures, the involucre and the corolla, have, however, been used much more than by previous writers.

The involucre varies principally in the size and number of bracts, and is important for specific distinction rather than to show lines or strains of variation. In this respect it differs from the corolla, in which the pale yellow, 4-toothed character is found practically constant among a number of related species, while the orange, 5-toothed type represents another group, both evidently distinct lines of development. But the corolla does not show all the lines of variation or even the primary ones. To determine these one must look to the achene. The number of awns is found to be much more constant than was before supposed. Only one species, *B. laevis*, really shows a variation in number without a corresponding change in other characters. Some allowance must, of course, be made for the fact that the outer achenes usually show a shortening of the awns which process is often carried so far that some are entirely obliterated.

In determining specific differences the direction of the barbs upon the margins of the achene seems to be of more importance than upon the awns. So far as known, no specimens of species having truly downwardly barbed achenes have been found with upwardly barbed awns; moreover, it seems possible that when erect barbs are found in *B. melanocarpa* and *B. connata* they are to be considered as a continuation of the hairs of the achene out upon the awns, thus excluding the real barbs, and not as a reversal of the barbs themselves. Whether this is really the case has not as yet been definitely settled. In some cases the erect barbs are nearly as slender as the hairs on the achene, but more often they are stouter. The hairs and warts upon the achenes, although more or less characteristic in some species, are not of special diagnostic value.

There has in the past been considerable discussion regarding the occurrence of hybrids among species of *Bidens* and *Coreopsis*. Every specimen, however, which the writer has seen labeled as such differs from one or the other of the supposed parents only in the direction of the barbs upon the awns. Although hybrids might be expected among these annual plants their occurrence is very doubtful.

If the direction of the barbs is not constant among the individuals of one species this character can obviously not be used for the separation of the genera *Coreopsis* and *Bidens*, a fact which has already been strongly emphasized by Dr. Britton. Indeed, a number of species of *Coreopsis* are evidently *Bidens* except for their barbs. The transferrence of these species to the genus *Bidens* becomes therefore necessary for a correct interpretation of the two genera.

The section PLATYCARPAE, the principal members of which are here treated, should therefore consist of the following species in northern North America: *B. frondosa*, *B. melanocarpa*, *B. discoidea*, *B. connata*, *B. comosa*, *B. bidentoides*, *B. dentata*, *B. cernua*, *B. laevis*, *B. Nashii*, *B. coronata*, *B. trichosperma*, *B. aristosa*, and *B. involucrata*.

The writer wishes to thank Dr. Robinson for kindly loaning the material in the Gray Herbarium, and Dr. Small for loaning that in the Herbarium of Columbia University; also the New England Botanical Club for the opportunity of studying a large amount of material from the vicinity of Boston; and especially Mr. E. P. Bicknell, a critical student of this group, who has generously furnished valuable suggestions and extensive notes upon many of the species.

Synopsis of the Species

A. Achenes upwardly barbed on the margins; corolla 4–5-toothed; awns 2; rays small or none.

Outer involucral bracts 4–8, inner oblong, equaling the disk or longer; ovaries of the ray-flowers hairy, minutely awned; achenes narrow, nearly black, hairy, papillose or tuberculate, rarely smooth, margins upwardly barbed to base of awns.

Corolla stramineous, 4-toothed; achenes long and very narrow, awns filiform, upwardly barbed; leaves simple; outer involucral bracts 4–5, inner longer than the achenes. 1. *B. bidentoides*.

Corolla orange, 5-toothed; achenes of ordinary form; leaves pinnate; inner involucre equaling the achene.

Leaves 3-foliolate, leaflets long-acuminate; heads very small (9 mm. broad), on very short peduncles; achenes very small (4.5 mm.), thickish, awns scarcely longer than the breadth of the achene, upwardly barbed; outer involucral bracts 4. 2. *B. discoidea.*

Leaves larger, 3–5-pinnate, leaflets acute to acuminate; heads larger; achenes 6 mm. long; awns half as long as the achenes or more, commonly downwardly barbed; outer involucral bracts 6–8. 3. *B. melanocarpa.*

Outer involucral bracts 10–16; inner ovate-triangular, short; corolla stramineous; heads long-peduncled; ovaries of the ray-flowers glabrous, awnless; achenes broad and flat (½ as broad as long) brown, nearly glabrous and smooth (rarely papillose); margins on the upper one-fourth downwardly barbed. 4. *B. frondosa.*

B. Achenes downwardly barbed, flat or flattish, brown, glabrous or nearly so, not tuberculate, slightly contracted at the top, awns 2–4; corolla usually stramineous, funnelform; outer involucral bracts 6–8; leaves except in no. 6 more or less petioled.

Rays wanting (or at least not exceeding the disk); corolla 4-toothed.

Achenes of small or medium size (8 mm. or less); awns 2 (except in one var.), ⅔ the length of the achene or less; leaves incised or parted. [*B. tripartita.*]

Achenes large (8–11 mm.; in var. 5–7 mm.); awns 3, over one half the length of the achene; leaves serrate. 5. *B. comosa.*

Ray flowers present, ligule one half longer than the disk; corolla 5-toothed; awns 4 (rarely 2); leaves deeply serrate or incised. 6. *B. dentata.*

C. Achenes usually both upwardly and downwardly barbed on the same margin, 4-angled, tuberculate; awns 4 (rarely 3); corolla orange, 5-toothed, abruptly contracted; leaves simple (sometimes deeply lobed); outer involucral bracts 4–7; heads commonly rayless. 7. *B. connata.*

D. Achenes downwardly barbed, biconvex or 4-angled, nearly glabrous, tuberculate on the angles, often striate, dark-green or blackish; awns 2–4; corolla deep yellow, 5-toothed, abruptly contracted; outer involucral bracts 8; heads large, often cernuous in fruit; rays commonly long and showy; leaves sessile.

Outer involucral bracts exceeding the disk, unequal, spreading, foliaceous; rays twice the length of the disk or less; leaves long (8–16 cm.), more or less clasping and connate, teeth distant; achenes 4-angled, slightly dilated at the summit. 8. *B. cernua.*

Outer involucral bracts rarely exceeding the disk, nearly equal and seldom conspicuously foliaceous, slightly fleshy; rays 2–4 times the length of the disk; achenes not dilated above, flat, 1-nerved on the outer face; plant sparingly branched above or simple, helianthoid in appearance; leaves shorter, rarely connate (5–12 cm.), teeth closer.

Leaves lanceolate, acute or short-acuminate, sharply serrate, not fleshy, usually tapering at the base; branches spreading; margin of the achene straight from awns to base. 9. *B. laevis.*

Leaves elliptic or oblanceolate-oblong, acute, minutely serrate or almost entire somewhat fleshy, some of the upper often very broad at the base, but rarely clasping; branches strict, erect; achenes slightly contracted at the summit. 10. *B. Nashii.*

1. BIDENS BIDENTOIDES (Nutt.) Britton, Bull. Torr. Bot. Club, **20**: 281. 1893

Diodonta bidentoides Nutt. Trans. Am. Phil. Soc. II. **7**: 361. 1841.

Coreopsis bidentoides T. & G. Fl. N. A. **2**: 339. 1842.

Erect and stout (20–80 cm.), stramineous, glabrous: branches short and spreading: leaves pale, undivided, lanceolate to linear-lanceolate (blade 6–10 cm.), on more or less margined petioles (2–5 cm.), regularly tapering to the acuminate apex, coarsely and distantly serrate-dentate, attenuate at the base, upper leaves shorter and on more margined petioles: heads on rather slender peduncles which are mostly shorter than the leaves, longer than broad (15–18 × 10–12 mm.), stramineous; outer involucral bracts 4–5, linear or linear-spatulate, 1–3 times the length of the disk, not ciliate, entire, erect; inner bracts 5, oblong-linear, barely acute (15 mm.) and with the chaff much longer than the flowers: ray flowers rarely present, ligule strap-shaped, not exceeding the head; the ovaries similar to those of the disk: corolla of the disk flowers pale-yellow, large (5 mm. long, ½ length of awns), funnelform, 4-toothed, basal portion equaling the upper: stamens rarely exserted: mature achenes very slender, linear-cuneate, convex (8–10 mm.), dark-brown, not papillose, hairy, margins upwardly hairy: awns 2 (rarely a third very short one) very slender and nearly as long as the achene, upwardly barbed.

.Muddy shores of the Delaware River and Bay, Pennsylvania to Maryland.

Specimens examined from:—Pennsylvania: Philadelphia, *Durand.* New Jersey: Camden, *Parker, Diffenbach;* Salem, *Commons.* Delaware: New Castle, *Canby;* Wilmington, *Canby, Commons* (with rays). Maryland: Bush River, *Canby.*

Of all the species of *Bidens* within our limits this is the most limited in distribution. It is, so far as known, confined entirely to the shores of the Delaware River and Bay, where it may be found growing in the mud at tide-water. The species is very constant in its characters as well as very unique, and must be considered as representing a line of development by itself. With *B. discoidea* it agrees only in having upwardly barbed awns and hairy achenes, but is remarkably distinct in the form of the achene and in the corolla. The foliage on the contrary resembles quite closely *B. comosa.* Its affinity seems not to be with any of the species dis-

cussed in this paper. The flowering period is from Sept. 1 to Oct. 15.

2. BIDENS DISCOIDEA (T. & G.) Britton, Bull. Torr. Bot. Club, **20**: 281. 1893.

Coreopsis discoidea T. & G. Fl. N. A. **2**: 339. 1842.

Stem tall and much branched, slender, reddish: leaves 3-foliolate, small, glabrous, petioles very slender (3 cm.), marginless; leaflets lanceolate to ovate-lanceolate, short (4–9 cm.), long-acuminate, sharply and coarsely serrate below the entire point, abruptly contracted at the base, the terminal on a long slender stalk (5–15 mm.), lateral slightly smaller on shorter stalks, uppermost leaves sometimes undivided, dark-green: heads very small and numerous (8–10 mm. broad), on very short peduncles (1–4 cm.), globular; outer involucral bracts linear to spatulate-linear, rarely longer than the disk, commonly 4, not ciliate, glabrous; inner bracts oblong or elliptic-oblong, obtuse (6–7 mm.), brownish, equaling the disk; chaff commonly reddish tipped: ray flowers none: corolla of the disk flowers very small (1.75–2 mm.), orange, equaling or slightly longer than the awns, campanulate-oblong above, 5-toothed, contracted into a basal portion shorter than the upper: stamens slightly exserted: mature achenes very small (4–5.5 mm.), rather narrow, cuneate, contracted at the summit, biconvex, black, hairy, tuberculate-papillose or nearly smooth, margins upwardly hairy, summit truncate, awns 2, very short (scarcely longer than the breadth of the achene), upwardly hairy.

Massachusetts to North Carolina (*Chapman*) and westward to Ohio, Louisiana and Texas.

Specimens examined from:—Massachusetts: Stony Brook Res., *Rich.* Connecticut, *Wright*, 1879. New York: Ithaca (many specimens); Oswego Co., *Wibbe*, *Rowlee*. New Jersey, Morris Co., *Porter*. Pennsylvania: Luzerne Co., *Heller*, no. 60. Delaware, *Canby*. Maryland, *Canby*. Ohio, *Sullivant*, 1839. Missouri, *Engelmann*. Arkansas, *Letterman*. Louisiana, *Hale*, 1842. Texas, *Lindheimer*, *Drummond*.

This species is on the whole less common in the eastern portion of its range than are most of the others, and judging from the specimens cited above it must be quite rare in New England. In New York and Pennsylvania it is found only near sphagnous bogs and mountain lakes, selecting preferably old logs and stumps that project out into the water. So far as observed it is quite constant

in its characters, and although some cases of retrorse awns have been reported* none have been observed by the writer. Its only close relative is *B. melanocarpa* from which it is often very difficult to distinguish some of the smaller forms. The smaller, more acuminate leaves, and smaller achenes with upwardly barbed awns are the only reliable distinguishing characters. Some of the western specimens are often quite robust. The flowering period is September and October.

3. **Bidens melanocarpa** sp. nov.

B. frondosa Torr. Fl. N. Y.; Darl. Fl. Cest. Not L.

Stem 50–70 cm. high or more, slender, bushy-branched, the branches mostly spreading: leaves pinnately 3–5-foliolate, glabrous or nearly so except the scabrous margins, petioles very slender, scarcely margined (3–4 cm. long); terminal leaflet (4–8 cm. long) lanceolate to oblong-lanceolate, acuminate, tapering into a long stalk (10–15 mm.), occasionally 3-lobed at base, sharply and saliently serrate with either medium or coarse teeth; lateral leaflets about ⅓ shorter, less acuminate, more truncate and often very oblique at the base: heads on slender ascending peduncles of medium length, rather small (largest about 15 mm. diameter), hemispherical or globular; outer involucral bracts 6–8, spatulate-linear, mucronate, entire, sparsely ciliate, equaling the disk or sometimes twice as long (10–15 mm.); inner bracts brownish, 8–12, oblong, scarcely acute (8 mm. long), apex slightly pubescent; chaff often reddish-tipped: ray flowers usually present, ligule broadly oval, equaling the disk, golden yellow, caducous, the ovaries narrowly and evenly cuneate, hairy, hairs on the margins in clusters and directed upward, summit convex, awns 2, divergent, scarcely longer than the breadth of the ovary, downwardly barbed: corolla of the disk flowers small (2.5–3 mm.), shorter than the awns, 5-toothed, orange, campanulate-oblong, slightly contracted below, basal portion shorter than the upper: stamens exserted: achenes in fruit (6 × 3.25 mm.) cuneate, slightly contracted at the summit, flattish, costate, nearly black, tuberculate, sparsely hairy, margins upwardly hairy to base of awns, summit truncate: awns short (⅓–½ length of achene), slender, slightly divergent, strongly downwardly barbed (rarely barbs erect).

New Brunswick to Florida, westward to Texas and Nebraska.

Specimens examined from:—New Brunswick: *Chalmers* (*ex* Macoun). Maine: *Parlin; M. E. Hill*, no. 93. New Hampshire:

* Britton, Bull. Torr. Bot. Club, **20**: 280. 1893.

W. Deane; Robinson, no. 361. Massachusetts: *Boott; Collins; Rich; French; Young.* Rhode Island: *Thurber.* New York: *A. M. Vail; Kearney; Britton; Rowlee, et al.* New Jersey: *Torrey; Commons; Halsted*, no. 36. Pennsylvania: *Smith* (upwardy barbed awns). West Virginia: *Millspaugh*, no. 778. Florida: *Chapman.* Alabama: *Buckley.* Louisiana: *Hale.* Texas: *Lindheimer; Reverchon.* Missouri: *Bush*, no. 167; *S. Weller.* Illinois: *Wolf; DeForest.* Nebraska: *Rydberg*, no. 1707; *Clements*, no. 2894.

Bidens melanocarpa pallida var. nov.

Slightly glaucous, branches all ascending or erect, conspicuously overtopping the terminal shoot: leaves smaller, on shorter more margined petioles (3–4 cm. long), dull, veins inconspicuous, the lower ternate, the upper undivided; leaflets shorter, ovate-lanceolate, short-acuminate, the terminal contracted at the base into a winged stalk and more or less confluent with the lateral, coarsely and sharply few-toothed: heads longer than in the type, on longer peduncles; outer involucre erect, foliaceous (2–4 times length of head), rarely ciliate; inner bracts oblong lanceolate: corolla of disk flowers larger (3–4 mm.), often 4-toothed, more nearly yellow, shorter than the awns: achenes (5–10 mm.), not papillose: awns longer (about ½ length of achene).

Nova Scotia to New York and Illinois.

Specimens examined from:—Nova Scotia: Halifax, *Brother Peter*, 1896. Illinois: *Wolf.* New York: Ithaca (many specimens).

This species is quite widely distributed throughout the eastern portion of North America, and is everywhere very abundant. In the New England states it seems to be the most common type of the *frondosa* group, but in New York State and farther westward *B. frondosa*, with which it has so long been confused, is equally abundant. It usually prefers rich damp soil and forms a large part of the vegetation along roadsides, in waste places, and on the margins of rivers and ponds during the autumn months. In structural characters it is more distinct than are *B. cernua* and *B. laevis*, but has nevertheless never been separated from *B. frondosa.* It is however much more closely related to *B. discoidea.*

B. melanocarpa is exceedingly variable. When growing in exposed localities it often has much narrower leaflets and is 5-pinnate, but when in shaded places the leaves are usually only 3-pinnate

and leaflets very broad. In the vicinity of sphagnous bogs it often becomes more bushy, with smaller leaves and more acuminate leaflets, in which condition it resembles *B. discoidea* very closely. The specimens with upwardly barbed awns collected by various botanists and thought to be hybrids between this species and *B. discoidea* or *B. bidentoides* can scarcely be considered as such since they do not show the necessary intermediate condition of other characters. In fact, with the exception of the barbs, all the characters are identical with those of this species. It seems better for the present to consider them as accidental forms of *B. melanocarpa.*

B. melanocarpa cannot be distinguished from the other species of North America by any one character. From *B. frondosa* it differs by its fewer involucral bracts, narrower upwardly barbed achenes and orange flowers; from *B. connata* by its 2-awned achenes and pinnate leaves; from *B. discoidea* by the larger, less acuminate leaflets, and larger more tuberculate and longer-awned achenes and more numerous involucral bracts. It is very closely related to *B. tripartita* of the Old World, some of the broader leaved forms of which differ only in having blunter teeth and downwardly barbed achenes with yellow corollas. It seems to form a transition between *B. tripartita* and *B. connata* on the one hand and between *B. discoidea* and *B. connata* on the other.

The var. *pallida* although widely distributed, judging from the specimens representing it in the larger herbaria, seems not to be very common. In the vicinity of Ithaca, N. Y., however, it is abundant along the shores of Cayuga Lake, where its habit makes it quite conspicuous. In many respects the reduction of the leaves and lengthening of the peduncles suggests a condition similar to that which in *B. connata* and *B. comosa* was determined to be a "second growth," but here the plants seem to be perfectly normal and healthy. Moreover they differ in some important structural characters regarding the head and achenes, and in the long branches overtopping the terminal head. Considering the character of the heads and achenes alone, it might almost be taken for a hybrid with *B. comosa*, but the leaves and general habit are not at all intermediate. It seems best at present to consider these forms as forming a distinct variety. The flowering period of *B. melanocarpa* is from Aug. 15th to Sept. 25th.

4. BIDENS FRONDOSA L. Sp. Pl. 832. 1753.

Also of Willd. (in part); Torr. Fl. N. U. S. (in part); Bigelow Fl. Bost.; T. & G. Fl. N. A.

Stem tall and branching, glabrous, furrowed, reddish, branches spreading: leaves pinnately 3–5-foliolate (commonly 5-) on slender marginless petioles (2–4 cm. long), scarcely paler beneath, glabrous or nearly so, the straight veins prominent; leaflets lanceolate, tapering evenly to the very acute apex, serrate, with numerous sharp or bluntish regular teeth, all abruptly contracted at the base and short-stalked, the lateral oblique; rachis narrowly margined: heads large (15–25 mm. broad), broader than high, on long stout peduncles (3–16 cm.); outer involucral bracts linear or narrowly spatulate, unequal, numerous (10–16), scarcely exceeding the disk (rarely twice as long), conspicuously ciliate, entire; inner bracts brownish-olive, 14–18, mostly ovate or narrowly triangular, often abruptly contracted at the pubescent apex, mostly shorter than the disk: ray flowers usually present, ligule elliptic-oval, equaling the disk, pale yellow or often whitish, caducous, the ovaries (5–6 mm. × 1½–2 mm.), cuneate, broader and shorter than in *B. melanocarpa*, slightly contracted at the summit, truncate, awnless, entirely glabrous except occasionally a few upward barbs on the margins near the summit: corolla of the disk flowers of medium size (2.5–4 mm.), funnelform, pale yellow, 4–5-toothed, not conspicuously contracted below, two thirds length of awns, basal portion shorter than the upper: stamens usually included: achenes in fruit large, very flat and broad (7.5–9 mm. × 4.5–5 mm.), cuneate, slightly contracted at the summit, brown or olivaceous, smooth or merely papillose, nearly glabrous, 1-nerved on each face, margins downwardly barbed on the upper fourth, hairs erect below, summit truncate, awns 2, erect or divaricate, ½ length of the achene or more, strongly downwardly barbed.

Ontario to North Carolina, Missouri and westward to California and British Columbia.

Specimens examined from:—Ontario: Hull, *Macoun*, 1889. New York: *Barrett, Britton, DuBois, Townsend, Wiegand, et al.* Pennsylvania: *Moser.* Kentucky: *Short.* Virginia: *Curtiss.* Illinois: *DeForest.* Wyoming: *Nelson*, no. 2749. Upper Platte, Torr. Herb. California: *Bidwell*, no. 328. Washington: Columbia River, *Suksdorf*, nos. 412 and 1591.

Bidens frondosa puberula var. nov.

Branches, leaves and involucre more or less finely crisp-pubescent, with whitish hairs, the last often densely so; inner bracts

pubescent on the back; leaves somewhat more finely and bluntly serrate.

Wisconsin and Missouri to the Saskatchewan.

Wisconsin: Green Bay, *J. H. Shutte*; Devils Lake, *Morgan*. Nebraska: *Webber*, 1886; *Clements*, no. 2894, 1893. Missouri: Courtney, *Bush*, no. 29, 1892. Saskatchewan, *Bourgeau*, 1857.

Bidens frondosa is common throughout the Middle and Western States, but does not seem to appear in New England. In late autumn it forms a very conspicuous part of the vegetation along roadsides and in waste places, especially where the soil is rich and damp, and may be found in flower from Aug. 15 to Sept. 15 or rarely until Oct. 1.

The plants produce ray flowers in considerable abundance in the earlier heads. They are, however, very caducous, and mostly absent altogether in the later heads; as a result of which a patch bearing rays early in the season may appear entirely rayless at a later period. Very few plants, if any, are entirely destitute of rays.

Considerable difficulty has been experienced in deciding whether Linnaeus' plant was of this species or the preceding. The original description which is rather longer than usual characterizes the leaves as pinnate and linear, seeds one half narrower than long, peduncles longer than the leaves; all of which indicate this species rather than *B. melanocarpa*.

Bidens frondosa is perhaps the most distinct of all the species in structural characters, although not in general appearance. Its two nearest relatives are *B. melanocarpa* and *B. tripartita*, from the former of which it may be distinguished by the longer peduncles, larger number of involucral bracts, the deltoid inner ones, the pale yellow corolla, form of the sterile ovaries of the ray flowers, and the broad, smooth, brown achenes, and from the latter by the pinnate leaves, long peduncles, outer and inner involucre, 5-toothed corolla and broad achenes.

Bidens tripartita L. of the Old World properly belongs here. It is closely related to *B. melanocarpa* and somewhat intermediate between that species and *B. frondosa*. Through it also *B. melanocarpa* is connected with *B. connata*, *B. comosa* and *B. cernua*. The typical form has 3-parted leaves and coarsely serrate divisions with the teeth usually rather blunt; but the variations are very great

and without doubt several species are now aggregated under one name. A simple-leaved pale form from central Europe with often only 3 awns and large foliaceous involucre is difficult to distinguish from some forms of *B. comosa*, and is probably the *B. tripartita integra* of Koch. Another simple-leaved form with small heads and corky-thickened 2-awned achenes from southern Europe and Asia is *B. tripartita tenuis* DC. A third form with comose often cernuous heads, incised sessile leaves and two awns connects this species with *B. cernua* and has been separated as *B. platycephala* Oersted.

B. tripartita is found throughout Europe, Asia and Japan, but so far has not been found in North America (Addison Brown reported it as a ballast plant at Hunter's Point in the vicinity of New York City, Bull. Torr. Bot. Club, **16**: 357. 1879).

5. BIDENS COMOSA (A. Gray) Wiegand, Bull. Torr. Bot. Club, **24**: 436. 1897.

B. connata DC. Prod.; T. & G. Fl. N. A.; Torr. Fl. N. U. S. (in part); Darl. Fl. Cest.

B. connata comosa A. Gray Man. 261. 1867 [ed. 5].

Pale throughout: stem stout, erect (30–80 cm.), glabrous, stramineous or sometimes reddish, internodes rather short; branches short, spreading: leaves undivided (8 cm. long), pale green, narrowly elliptic or elliptic-lanceolate, acute, attenuate at the base into a short strongly margined petiole, serrate with rather small regular teeth (rarely coarser ones, and the upper nearly entire): heads not numerous, large (12 mm. high × 12–18 mm. broad) nearly globular or broader, on short stout peduncles thus often appearing clustered, erect; outer involucral bracts 6–8, linear or linear-lanceolate, mucronate, usually entire, very large, conspicuous and unequal, 2–5 times the length of the disk (30–50 mm. long), nearly erect; inner bracts oblong-ovate to ovate-lanceolate, acutish, stramineous, about 8 in number: ray flowers wanting: corolla of the disk flowers large (5 mm.), narrow funnelform, pale yellow, 4-toothed, gradually contracted into a basal portion which is longer than the upper, equaling the awns: stamens and style included: mature achenes large and flat (8–10 mm. × 3 mm.) scarcely carinate, cuneate with a broad base, slightly contracted at the summit, dark olive-green or brownish, not papillose and glabrous or nearly so, often dark-punctate, margins strongly retrorsely barbed, summit convex; awns 3, long and conspicuous (two long ones ⅔–¾ length of achene, third shorter, rarely a fourth very minute), erect, retrorsely barbed.

Maine to West Virginia, westward to Minnesota and Colorado and from Western Georgia (Chapman), Louisiana.

Specimens examined from :—Maine : Orono, *Fernald.* Massachusetts : Revere, *H. A. Young.* New York : *Torrey, Britton, Hulst* (many from central N. Y.). New Jersey : *Parker, Nash.* West Virginia : near Bucklin, *Pollock.* Tennessee : *Ruth*, no. 32. Kentucky : *Short.* Ohio : *Werner, Lea*, no. 167 (Torr. Herb.). Illinois : *Chapman, DeForest.* Minnesota : *Holzinger.* Kansas : *Norton*, no. 281, Riley Co. Missouri : *Bush*, no. 167 (in part). Louisiana : *Hale.* Colorado : Lincoln Co., *Rydberg*, no. 190.

Bidens comosa acuta var. nov.

Habit as in the type, but leaves sessile or nearly so : heads much broader (broader than high, 10–20 mm. broad) and achenes more spreading ; outer involucral bracts only twice the length of the disk or less, conspicuously spreading, lanceolate, acute and apiculate ; inner narrowly triangular-lanceolate, acute.

Kansas and Missouri.

Specimens examined :—Kansas : Manhattan, *Norton*, 1892. Missouri : *Engelmann*, St. Louis, 1866. Missouri : *Bush*, no. 164, Jackson Co. ; nos. 31 and 49, Courtney Co.

Bidens comosa is common throughout the Middle States and Mississippi Valley growing preferably in rather dry soil. Its usual habitat is along roadsides where the soil is rich, or on the sandy margins of lakes and rivers.

When growing undisturbed it often becomes so numerous as to form dense patches to which the pale upright stems and short branches give a characteristic appearance. Certain specimens however from widely separated localities (the Short, Hale and Werner specimens cited above, and others) present an entirely different aspect. The stems are decumbent at the base ; the leaves are shorter, blunter, more sparsely and bluntly toothed or the upper entire ; and the involucre of the long-peduncled heads is very foliaceous, with broad obtuse bracts. At first it seemed proper to separate this form as a distinct variety, but in the study of specimens from the vicinity of Ithaca similar plants were found but apparently always as a second growth after the main stem had been injured or cut away by the mower. It may be possible that the similar variation in *B. connata* is from a like cause. The same variation also occurs in the var. *acuta.*

B. comosa is distinguished from all other American representatives of the genus by its broad, 3-awned, retrorsely margined achene; from *B. connata* it differs also by its short branches, stout peduncles, pale leaves, very foliaceous involucre of usually more numerous bracts, and long pale 4-toothed corolla with included stamens; from *B. bidentoides* by the three downward-barbed awns and flat retrorse achenes; and from *B. cernuus* by the 5-toothed corolla, included stamens, 4-awned and angled achene, and by the erect heads. The flowering period is from September 1st to October 1st.

Its closest affinity is however with *B. tripartita integra* Koch (3-awned) a native of central Europe. This variety can be distinguished from the "second growth" American plants only by the slightly shorter involucre, smaller, slightly narrower, and thicker achenes with shorter awns. Through *B. tripartita* the American plant is connected with *B. frondosa* and *B. connata*, and through *B. platycephala* of Europe with *B. cernua*.

6. **Bidens dentata** (Nutt.)

B. chrysanthemoides Hook. Fl. Bor. Am. **1**: 314. 1833. (According to T. & G.) Not of Michx.

B. quadriaristata dentata Nutt. Trans. Amer. Phil. Soc. II. **7**: 368. 1841.

B. cernua elata T. & G. Fl. N. A. **2**: 352. 1842.

Stem very stout (40–100 cm.), glabrous or sparsely hirsute, branches short or the upper longer and ascending: leaves pale, often very large (8–18 cm. long), broadly lanceolate, oblanceolate, or oval, acute or short acuminate, contracted at the nearly sessile base, coarsely serrate, incised or rarely even parted, upper leaves nearly as large: heads few (1–3), large and nearly sessile, broader than high (20 mm. diam.); outer involucral bracts about 8, linear to oblanceolate, usually longer than the head, very unequal, some often very foliaceous and incised, conspicuously ciliate below; inner bracts elliptic-ovate, acutish: ray flowers present, ligule one half longer than the disk, oval, pale yellow, the ovary broadly oblong, glabrous except the strongly retrorse margins, awnless: corolla of the disk flowers large (4–5 mm.) funnelform, gradually contracted below, 5-toothed, deep yellow: achenes large and rather broad (3 × 8 mm.), flat, glabrous, brownish, broadly cuneate, slightly contracted at the summit; margins sparsely retrorse with small barbs the lowermost of which are often erect, summit concave:

awns 4 (rarely 2) unequal, about one half the length of achene, retrorsely barbed.

British Columbia near Vancouver.

Specimens examined:—De Fuca, *Scouler*. N. W. Coast, in Gray Herb. from Hooker. Vancouver Island, *Macoun*, no. 73.

This very distinct species, although collected for the first time many years ago, is represented in the herbaria by only a very few specimens. The three cited above are quite similar in general appearance and are characterized by the numerous large pale leaves which are often conspicuously incised, and among which at the summit of the stem the one to three broad and nearly sessile heads are borne. These in form are much like those of *B. cernua*, but they are erect, the rays are pale and very short, and the involucre is more foliaceous. The achenes are however quite unlike those of *B. cernua*, but are so similar to those of *B. comosa* as to sometimes render it difficult to distinguish the two species from this character alone. In structural characters this species seems to stand almost intermediate between *B. cernua* and *B. comosa* on the one hand and between *B. cernua* and *B. frondosa* on the other. It resembles the *B. bullata* L. of Europe which however has rayless heads, hairy stem and leaves and always two-awned achenes.

7. BIDENS CONNATA Muhl. Willd. Sp. Pl. **3**: 1718. 1804. Pursh Fl. Am. Sept.; Torr. Fl. N. U. S.?

B. tripartita Bigelow, Fl. Bost. 294 [ed. 2].

B. petiolata Nutt. Jour. Acad. Philad. **7**: 99.

B. tripartitus var. *fallax* Warnstorf, Verh. d. Bot. Verein d. Prov. Brand. **21**: 157. 1879.

B. decipiens Warnstorf, Oesterr. Bot. Zeitschr. **10**: 392. 1895.

Stems tall and moderately branched (5–14 dm. high), glabrous and purplish, internodes rather long, branches usually spreading: leaves undivided or some of the lower ones deeply parted near the base, lanceolate, elliptic-lanceolate, or elliptical, large (12–35 mm. × 70–130 mm.), acuminate, tapering at the base, coarsely and saliently serrate with sharp teeth, bright-green, the petiole slender (2–4 cm. long), scarcely margined, or sometimes short and margined: heads of medium size, slightly broader than high (broadest 15 mm.), on rather short peduncles; outer involucral bracts 4–5, linear or spatulate, rarely much exceeding the disk, not ciliate; inner bracts about 8, brownish, oblong-ovate to elliptic-oblong, mostly

obtuse (7–8 mm. long): ray flowers rarely present, ligule golden-yellow, oblong, one half longer than the disk, ovary short and broad, awnless, hairy: corolla of the disk flowers of medium size (2.5–3.5 mm.), equaling the awns, upper portion oblong, 5-toothed, abruptly contracted into a lower portion which is as long as the upper: stamens exserted: mature achenes (4–6 mm. long), cuneate, very slightly contracted at the top, outer 3-angled and often 3-awned, inner 4-angled and 4-awned, dark-green or black, covered with brown or yellow warts, slightly hairy, barbs on the margins either erect or retrorse even upon the same achene, summit slightly convex; awns ⅓–½ the length of the achene, downwardly (rarely upwardly) barbed.

Massachusetts and New Hampshire to Virginia and westward to Missouri and Minnesota.

Specimens examined from:—Massachusetts: *Rich, Collins, Boott, Williams, et al.* New Hampshire: *Deane.* Rhode Island: Providence, *Thurber.* Connecticut: *Eaton* (with rays). New York: *Townsend, Vail, et al.* (many from Ithaca). Ontario: Lake Erie, *Macoun*; St. Catharines, *McCalla.* New Jersey: *Torrey*; *Nash.* Virginia: *Curtiss.* Ohio: *Selby*, no. 6 (up-barbed). Illinois: *Wolf*, no. 155; *Hall.* Missouri: *Bush*, no. 36. Minnesota: *Taylor.*

BIDENS CONNATA PINNATA Watson, A. Gray, Man. Bot. 284. 1890 [ed. 6].

Stem rather stout (40–70 cm.), much branched from near the base: leaves pinnately divided into from 4 to 6 pairs of narrowly linear (10–20 mm. long), acute, entire or incised distant divisions: heads numerous, similar to the type; chaff reddish tipped: achenes small, blackish, nearly smooth; awns slender, downwardly barbed as are also the margins of the achenes.

Vicinity of St. Paul, Minnesota.

Specimen examined: Richfield, Minn., *Couillard*, (type). (Also Ramsey Co., *Sandberg*, Minn. Bot. Stud., p. 572.)

Bidens connata is apparently confined entirely to the Northern States and is not found in the South as has heretofore been supposed. The southern plant seems in all case to be *B. comosa* instead. *B. connata* is very common throughout New England, the Middle States and the Mississippi valley, growing preferably in very wet soil, and is characteristic of ditches and wet swamps.

This species is one of the most variable of the whole group almost all portions of the plant being subject to change. In New England the leaves are shorter petioled, while in the West the petioles are often very long (4 cm.). Some specimens from the Eastern and Middle States have much narrower, nearly sessile leaves. Specimens from Ithaca, N. Y., and Ohio (Selby) as well as one in the National Herbarium collected by Dr. Vasey near Washington have upwardly barbed awns but other characters the same as in the type. At Ithaca these upwardly barbed plants grow over a considerable area almost to the exclusion of the normal form; but many transitional specimens were found in which the awns bore barbs extending in either direction. In addition to these variations one often finds in sphagnous bogs and especially on decaying logs along the borders of lakes, pools and slow-flowing streams a very small form (5–20 cm.) bearing one or two few-flowered oblong heads, and small, spatulate-oblong, petioled, nearly entire leaves. However, when the place of growth becomes more congenial it seems to pass directly into the normal form.

A very interesting form is the var. *pinnata* Wats. from Minnesota. It seems to have a very limited range, being confined to two or three localities in the vicinity of St. Paul. The pinnate finely divided leaves and smoothish achenes make it a very conspicuous plant and almost specifically distinct. The limited distribution at first suggested its being a hybrid; but no other species is known that could give such a combination of characters with *B. connata*. It should be looked for in other districts of the West.

The question as to whether Muhlenberg's type was really this species or *B. comosa* is a somewhat perplexing one. It seems, however, to be now quite definitely settled that the present interpretation is correct, both from a study of the original description, and from specimens which Prof. Ascherson has compared with the Muhlenberg material at Berlin, and which the writer has had an opportunity to examine through the kindness of Dr. Robinson.

*B. connata** has in recent years found its way into Europe.

* The literature upon the occurrence of *B. connata* in Europe is as follows:

Warnstorf, Verhand. d. Bot. Verein. d. Prov. Brandenb. **21**: 157. 1879. Oesterr. Bot. Zeitschr. **10**: 392. 1895; **12**: 475. 1895. Bot. Gaz. **25**: 58. 1898.

Ascherson, Verhand. d. Bot. Verein. d. Prov. Brandenb. **37**: L. 1895; **38**: LIII. 1896. **39**: XC. 1897.

First reported in 1879 by Warnstorf from a locality in Germany (as *B. tripartita fallax*), it was later found in other localities by the same person, and is now known to be widely spread over Central Europe. Along with it was found another *Bidens* identified as *B. frondosa*, then a novelty for Germany, but having many years previously been introduced into Italy. From the description given it is not quite clear whether this is our *B. frondosa* or *B. melanocarpa*, but probably the latter.

Bidens connata is closely related to *B. tripartita* of Europe and more remotely with *B. laevis*. In North America it is one of the most distinct of all species of *Bidens*. From *B. tripartita* it may be distinguished by its 4-awned and angled, tuberculate achenia, and orange flowers; from *B. laevis* by the tuberculate achenia, absence of rays and more petioled leaves; and from *B. melanocarpa* by the 4-awned achenia and usually simple leaves. The flowering period of this species is from September 1 to October 1.

8. BIDENS CERNUA L. Sp. Pl. 832. 1753

Also Willd. Sp. Pl.; Pursh, Fl. Am. Sept.; Bigelow, Fl. Bost.; Fl. Dan. *pl. 841*; DC. Prod.; Torr. Fl. N. U. S.; T. & G. Fl. N. A.; Gray, Synop. Fl. N. A.; Macoun, Cat. Can. Pl.

B. cernua minima Willd. Sp. Pl. **3**: 1717. 1804.

B. minima Huds. Fl. Ang. 310. 1762; L. Sp. Pl. 1165, ed. 2; Fl. Dan. *pl. 312*.

Pale throughout: stem rather low (20–70 cm., rarely a meter), erect, glabrous, stramineous or reddish, sometimes sparsely hispid; branches short, rarely exceeding the subtending leaves, decreasing in length down the stem: leaves long and narrow, undivided, lanceolate or linear-lanceolate, sessile and more or less connate by a broad base, only slightly contracted below the middle, acuminate, serrate with coarse acute spreading distant teeth (or in coast plants, with smaller teeth) (6–16 cm. long): heads very large especially in fruit (disk 1.5–2.5 cm. broad), broader than high, before anthesis erect, becoming strongly cernuous in fruit, on short rather stout peduncles (2–4 cm.), often appearing clustered; outer involucre about 1½–3 times the length of the disk, bracts 7–8, obtusish, unequal, entire, linear or linear-lanceolate, spreading or reflexed; inner bracts about 8, ovate-oblong or oval, acutish, olive-yellow; chaff rarely if ever colored: ray flowers usually present, ligule pale or bright yellow, about ¼ longer than the disk, narrowly

elliptic, obtuse, caducous, ovaries short and broadly-oblong, glabrous except the strongly retrorse margins, summit truncate and without awns: corolla of the disk flowers large (4–5 mm.), pale or deep yellow, longer than the awns, campanulate-oval above, very abruptly contracted into a lower portion which is longer than the upper, 5-toothed: stamens slightly exserted: achenes small (5–6 mm.), olive, narrowly cuneate, slightly dilated at the summit, glabrous, margins strongly, almost serrately retrorse-barbed, rarely tuberculate except on the margins, strongly carinate on both faces (almost 4-angled), carinae retrorse, summit convex; awns 4 (½ length of achene), straight, retrorsely barbed.

Nova Scotia (*Macoun*) and Canada to North Carolina, Missouri and westward to the Pacific coast.

Specimens examined from :—Maine: *Fernald* (bog form); *M. E. Hill, Parlin.* Canada: Port Arthur, *Britton;* P. E. I., *Macoun;* Quebec, *Berg;* Ont., *McCalla, Scott.* New Hampshire: *Deane, Robinson,* no. 400. Massachusetts: *Rich, Collins.* Rhode Island: *Thurber, Olney.* New York: *Kearney, Dudley, DeForest, DuBois, Townsend, Schrenk.* New Jersey: *Parker, Britton.* Delaware (? *Tatnall,* awns 2). Virginia: *Curtiss.* Maryland: *Shriver.* North Carolina: *Huger* (Waynesville). Tennessee: *Ruth.* Illinois: *Chapman, DeForest.* Missouri: *Engelman.* Lake Superior: *Loring.* Wisconsin: *Gillman.* Wyoming: *Nelson,* no. 1707. Montana: *Scribner,* no. 108. Saskatchewan: *Bourgeau.* Oregon: *Lyall.* Washington: *Suksdorf,* no. 1592. British Columbia: *Macoun,* no. 458. California: *Michener* and *Bioletti.*

Bidens cernua elliptica var. nov.

B. cernua, in part, of many authors.

B. chrysanthemoides Pursh, Fl. Am. Sept.; Torr. Fl. N. Y. (in part); Darl. Fl. Cest.; Macoun, Cat. Can. Pl.

B. chrysanthemoides var. δ T. & G. Fl. N. A. **2**: 353. 1842.

? *B. cernua Coreopsis* Willd. Sp. Pl. 1716. 1804; Pursh, Fl. Am. Sept.

? *Coreopsis Bidens* L. Sp. Pl. 908. 1753. In part.

Plant much larger than the type (.5–1.5 m.), and more bushy-branched, the branches often exceeding the leaves, those at the middle of the stem longest: leaves larger (10–18 cm. × 2–4 cm.), elliptic-lanceolate or elliptical, acuminate, conspicuously tapering toward the base which is but slightly connate, more evenly and

closely serrate: heads as in the type but more numerous: rays variable but commonly longer than in the type (1½–2 times length of disk).

Massachusetts to Kentucky, and westward to Kansas and the Pacific coast.

Specimens examined from: — Massachusetts: *Tuckerman, Faxon, Chambers, Swan, Collins, Young, Frohock.* Connecticut: Eaton. New York: *Stewart, Wiegand.* New Jersey: *Haxamer* and *Maier.* Pennsylvania: *Brinton.* Kentucky: *Short, Kearney:* no. 475. Illinois: *Bebb,* Kansas, Riley Co., *Carleton.* Wyoming: *Nelson,* no. 2724. British Columbia: *Macoun,* no. 457. Washington: *Suksdorf,* no. 932, 933. Oregon: *Cusick.*

Bidens cernua integra var. nov.

Large and stout, resembling var. *elliptica,* but the large leaves are not so much narrowed at the broad connate base, and are minutely serrate or nearly entire.

Missouri and Nebraska.

Specimens examined:—Missouri: Jackson Co., *Bush,* no. 165 and no. 34. Nebraska: Hooker Co., *Rydberg,* no. 1697; at Ainsworth, *Clements,* no. 2920.

Bidens cernua is one of the most widely distributed species of the genus, and is found throughout Europe and Asia as well as across the entire northern portion of North America. It grows preferably in very damp situations or in water, and in most parts of the eastern United States may be found abundant in ditches, along the borders of wet swamps, and especially on the muddy banks of lakes and rivers.

It is exceedingly variable in stature, foliage and length of involucre and rays. Nnumerous specimens also connect the type with *B. laevis* by an almost complete chain of intermediate forms. The essential characters of these two species are almost exactly the same, and one must depend for specific distinction on those characters to which is due the difference in general appearance. However, certain lines can be drawn which are fairly distinct, and in the interest of clearness it seems much better to break up the group as has here been done.

The specimens representing the typical form resemble very

closely those of Europe, although more commonly radiate. They are all plants of low or medium stature, having large, more or less clustered heads with rays scarcely longer than the disk, sometimes entirely wanting; and what is more important, long, linear-lanceolate leaves, broad at the base and acuminate, with distant teeth. The heads are somewhat paler in color and the lower are on short branches close to the stem.

The plants may flower when very small and dwarf. Such specimens usually have a large involucre and shorter more entire leaves. In addition, there is a bog form analogous to the one described under *B. connata*. These plants grow on floating logs and in *Sphagnum*, and are very dwarf (4–14 cm.), with very small (2–4 cm.) spatulate entire leaves. On the other end of the log, however, may be larger specimens easily recognized as normal. This form is possibly the *B. minima* of Hudson, but in this country at least it is evidently not to be distinguished from the type.

A comparatively distinct form has been separated as var. *elliptica*. The large size of the plant, the broader leaves tapering at the base and closer serratures together with the longer rays has led to its being included often with the next species, but a comparison of the specimens shows that it is much more closely related to *B. cernua*. The shorter rays and foliaceous involucre are the best characters by which it may be separated from *B. laevis*.

B. cernua, like many other species of the genus which enter the confines of Missouri, has undergone variation. The form here described as var. *integra* is very distinct in appearance, and constant enough to warrant its separation. The flowering period of *B. cernua* is from Aug. 10 to Oct. 15.

9. BIDENS LAEVIS (L.) B.S.P. Prelim. Cat. N. Y. 29. 1888.
Helianthus laevis L. Sp. Pl. 906. 1753. Pl. Gronov.

Bidens chrysanthemoides Michx. Fl. Bor.-Am. **2**: 136. 1803. Also of Willd. Sp. Pl.; DC. Prod.; Elliot, Fl. S. C.; Torr. Fl. N. U. S.; T. & G. Fl. N. A. var. *α* and *γ*.

Bidens quadriaristata DC. Prod. **5**: 595. 1836.

Coreopsis Bidens Walt. Fl. Car. 215. 1788.

? *Coreopsis perfoliata* Walt. Fl. Car.

Stem (.5–1 m. tall) glabrous, tinged with purple, erect, branches

ascending, longer than the leaves and all borne above the middle of the stem: leaves simple, small or of medium size (7–13 cm.) lanceolate or more commonly elliptic-lanceolate, glabrous, scarcely paler beneath, more or less contracted toward the sessile base, rarely clasping, acute or short acuminate, serrate with small inconspicuous teeth, rarely the upper slightly connate: heads of medium size (disk 15–22 mm. broad) on long (3–10 cm.) slender pedicels, globular or rarely in fruit broader than high; outer involucral bracts 7–8, equaling or but slightly longer than the disk, bracts linear to spatulate-linear, slightly ciliate or glabrous, nearly equal, slightly fleshy, obtusish, appressed or spreading, often crisp-wavy in drying; inner bracts about 8, oval, stramineous, equaling the disk; chaff usually reddish-tipped: ray flowers present, the ligule very large (2–3 cm. × 8–14 mm.), elliptical or oval, rounded at the apex, golden-yellow: ovaries short-oblong, glabrous except the retrorse margin, summit truncate, awnless: corolla of the disk flowers deep-yellow, large (4.5–5 mm. long), equaling or exceeding the awns, campanulate-oval above, very abruptly contracted into a basal portion which is slightly longer than the upper, lobes 5, spreading: stamens long-exserted: achenes in fruit (6–9 mm. long) evenly cuneate from the summit, not dilated at the top, glabrous, flattish or rarely slightly carinate on one face, strongly and almost serrately retrorse on the margins, olive-green, convex at the summit: awns 2–4, ½–⅔ the length of the achene, downwardly barbed.

Massachusetts to Georgia (?) along the coast, and in Central New York. Possibly also in Mexico.

Specimens examined from:—Massachusetts: *Boott;* Essex Co., *Oakes;* Dedham, *Harris;* Acton, *Swan;* Andover, *Young;* Rhode Island: *Thurber.* New York: Cayuga Marshes, *Clinton;* Oswego Co., *Rowlee;* Torr. Herb. (N. Y. ?). New Jersey: *Poggenburg* (?); Hudson Co., *Hexamer* and *Maier* (anomalous); *Brinton.* Delaware: *Britton, Tatnall.* Virginia: *Hollick* and *Britton.* North Carolina, *Dinwiddee* at Raleigh.

B. laevis as here limited contains a group of very similar forms. They are characterized by a more slender habit than *B. cernua*, and more ascending branches all near the summit of the stem; the leaves are smaller, the involucral bracts decidedly shorter and thicker, and the achenes are less strongly carinate; but what is still more important, the whole plant when in flower has a distinctly helianthoid appearance quite distinct from *B. cernua.* The character as to whether the heads are cernuous or not is of some-

what questionable value. In the present species they are often slightly nodding in fruit. Many specimens named *B. laevis* in the herbaria are simply plants of *B. cernua* just coming into flower at which time the heads of that species may also be erect.

Recent botanists have substituted the name *B. laevis* L. for the *B. chrysanthemoides* of Michaux. Whether this should be done or not depends on one's attitude regarding the interpretation of Linnaean names. The recent practice has been to interpret the species of Linnaeus as far as possible by his citation of the older authors; and indeed in many cases this is the only way in which the species can be recognized. But in this case it is found that while the unusually long description of *Helianthus laevis* is contradictory to a conception of *Bidens*, the figure of Gronovius there cited represents without doubt the *B. chrysanthemoides* Mx. However, notwithstanding this contradiction, it seems preferable even here to apply the custom of interpretation by citation, and consequently the name *B. laevis* has been used in this paper.

B. laevis is really a coast plant and except in one or two instances seems never to penetrate far inland. The New York. specimens indicate that this species also is a member of the little community of coast plants growing isolated in Central New York, and of which *Listera australis* is a member. The most southerly specimens examined were from North Carolina, but it seems probable that the species extends even as far as Georgia. The flowering period is from August 15th to October 5th.

Although this species normally has an involucre scarcely exceeding the disk, two or three large coarse plants with leaves 16 cm. long from New Jersey (Centre Square, *Brinton*), and Delaware (Wilmington, *Tatnall*) have bracts approaching those of *B. cernua* in length and foliaceous character; but the achenes are of *B. laevis*.

10. BIDENS NASHII Small, Bull. Torr. Bot. Club, **25**: 481. 1898
B. chrysanthemoides var. β, T. & G. Fl. N. A. **2**: 353. 1842.

Plant tall and rather stout (30–80 cm.), glabrous and more or less succulent, simple or with a few short erect branches near the summit; internodes often long: leaves ascending thickish (5–12 cm. × 20–35 mm.), oblong-lanceolate to oblanceolate-oblong, broader than in *B. laevis*, from barely acute to acuminate at the

apex, slightly contracted toward the broad sessile, but scarcely connate base which in the upper leaves is very broad; veins inconspicuous, margins serrate with very fine teeth or nearly entire: heads few or often solitary (disk 15–20 mm. broad), erect or slightly nodding on long erect peduncles (2–7 cm.); outer involucral bracts 8, nearly equal, not exceeding the disk, fleshy, linear to linear-spatulate obtuse, glabrous, appressed or spreading; inner bracts oval acutish; chaff yellow: ray flowers present, ligules very large (15–35 mm. long × 10–12 mm. wide), elliptic, obtuse, deep-yellow; ovaries oblong, glabrous except the retrorse margins, truncate and without awns: corolla of the disk flowers large (4 mm.), deep yellow, equaling the awns, oblong-campanulate above, abruptly contracted into a slender basal portion, 5-toothed: stamens long-exserted: achenes in fruit small (5–6 mm.) narrow, cuneate, slightly contracted at the truncate or concave summit, flat, 1-nerved on outer face, margins retrorse, almost serrate: awns 2–3 (⅔–¾ length of achene), erect, retrorsely barbed.

Florida to Southern California.

Specimens examined from:—Florida: *Chapman*, *Nash*, Leon Co., no. 2336. Louisiana: *Hale*, no. 403 (type of T. & G. var.), *Carpenter*. Texas: *Lindheimer*, no. 435; Rio Grande, *Schott*. California: San Bernardino, *Wright*; Los Angeles, *Brewer*, no. 91; San Francisco, *Bolander*, no. 2405.

The three specimens of this species cited by Dr. Small in the original description, from Florida and Louisiana, differ from the Californian and Texan plants only in the less acute leaves, while the essential characters remain the same.

As appearing in the herbarium this species is quite different from *B. laevis* in general appearance, due mostly to its fleshy character, small serratures and broad leaf base. The achenes also seem to be slightly narrowed at the top and truncate after the manner of *B. connata*. The differences seem constant enough to warrant its recognition as a species.

CORNELL UNIVERSITY.

Studies in the Asclepiadaceae.—IV

By Anna Murray Vail

I. NOTES ON SOME OLD TYPES, WITH DESCRIPTIONS OF NEW OR LITTLE KNOWN SPECIES

Asclepias scaposa Vail, Bull. Torr. Bot. Club, **25**: 171. 1898

On a specimen of this species in Wright's New Mexican collection, no. 1683 in part, preserved in the Herbarium of the British Museum, I was fortunate to find a somewhat mature but complete flower, which through the courtesy of Mr. James Britten I was permitted to examine closely, so that to my former description I am able to add the following:

Corolla-segments 5 mm. long, apparently white; column short and broad; hoods of the corona barely exceeding the anthers, 2–2.5 mm. high, white or whitish, slightly pendulous or saccate at base, 5-dentate at the apex; central tooth rounded, the intermediate teeth acutish, the two ventral ones infolded, erect, slender, attenuated, nearly twice as long; horn arising from about the middle of the hood, slender, exserted; anther-wings salient and somewhat rounded at the base, apparently entire.

In floral structure allied to *A. quinquedentata* Gray and to *A. Palmeri* Vail, but its low habit and solitary terminal peduncle are, with few exceptions, rather unusual in the genus. I have seen only four specimens of it, the one in the Herbarium of Columbia University (Wright, no. 1684 in part), a fragment in Herb. Gray from the same collection (no. 1683 in part), the specimen mentioned above, and the one referred to below. In the first three cases it has been distributed with *A. longicornu* Benth. and *A. parviflora* Willd. (*A. perennis parvula* Gray). The fourth specimen is in the Herbarium of the Missouri Botanic Garden and is on a sheet with a specimen of (probably) *A. longicornu* Benth. in fruit only, the label bearing the following inscription: "No. 7, *Ascl. longicornu*, Wright, 1851."

Asclepias parvula (A. Gray)

Asclepias parvifolia Willd.? Torr. Mex. Bound. Surv. 164. 1859. Not Ait. 1789.

Asclepias perennis var. *parvula* (A. Gray) Proc. Am. Acad. **12**: 70. 1876.

Asclepias nivea Hemsl. Biol. Centr. Am. **2**: 325 and **4**: 69. 1881–2. Not Linn. 1753.

Pale gray-green throughout. Stem woody at the base, 3 dm. high, or more, erect, pubescent, often branched above: leaves short-petioled; blades lanceolate or oblong-lanceolate, tapering at each end, 4–6 cm. long, rather thick and coriaceous, glabrous or minutely puberulent above, puberulent beneath on the veins and revolute margins: peduncles 3–9, terminal and lateral, 1–4 cm. long; umbels 10–20-flowered: corolla white, small; column slender; hoods hastately sagittate at the base, not exceeding the anthers; horn falcate, thin, exserted, inflexed over the anthers: anther-wings narrow, entire at the salient base: follicles slender-fusiform, tapering to each end, 7–9 cm. long, glabrous: seeds 7 mm. long, red-brown, very thin, glabrous; coma 2–3 cm. long, abundant.

Mexican Boundary Survey, Head of Rock Creek, Bigelow, July 7, 1852; "*New Mexico*," Wright; *Texas:* Havard, Neally; *Mexico:* Palmer, no. 812.

The Wright specimen [no. 1684 in part] enumerated here is in the Herbarium of Columbia University. No. 1683, also of Wright's collection, contains besides *A. parvula* some specimens of *A. longicornu* Benth. (the plant since described as *Podostemma Emoryi* Greene, Pitt. **3**: 237), and some specimens of *A. scaposa* Vail.

Stelmagonum ? Holtonii

A low perennial herb. Root slender, vertical: stems slender, twining above, granular-puberulent and thinly hirsute with stiff spreading hairs, the lower portion with small corky-barked ridges: leaves opposite, on slender, granulose-puberulent and hirsute, 1.5–2.5 cm. long petioles; blades ovate-cordate, 3–4 cm. long, 1.5–2 cm. wide, acuminate at the apex, basal lobes rounded with narrow open sinus, granular-puberulent and with a few scattered short stiff hairs above, granular-puberulent and with more numerous stiff hairs beneath, especially on the veins, margins ciliate: flowers 4–7 in short-peduncled bracteolate cymes: peduncles axillary, 3 cm. long; pedicels 4–5 mm. long, the bracteoles subulate, very small, persistent: calyx 5-parted to below the middle, 2–3 mm. long, granular-puberulent and ciliate; segments acuminate, with an erect subulate gland in each sinus: corolla campanulate, 7–8 mm. long ? or more, 5-parted to a

little below the middle, minutely granular-puberulent on the outer surface; segments oblong, obtuse, glabrous within; crown cohering to the corolla and to the raised gynostegium, cup-shaped, 5-lobed, each lobe abruptly contracted into a slender, linear 1 mm. long, erect ligule: stigma rounded, scarcely depressed: pollinia orbicular, horizontal or ascending on rather broad, winged caudicles; corpuscle nearly rhombic. Follicles not seen.

New Grenada: Goudot; Flora Neogranadina-Magdalena, I. F. Holton, Opia, no. 461, Dec., 1852.

Both of these specimens are in the Kew Herbarium and a duplicate of the Holton number is in the Herbarium of Columbia University.

Mellichampia ligulata (Benth.)

Enslenia ligulata Benth. Pl. Hartw. 290. 1848.

Mellichampia rubescens A. Gray; S. Wats. Proc. Am. Acad. **22**: 437. 1887.

For some time past I have suspected the identity of *Mellichampia* with *Enslenia ligulata* and through the courtesy of the Director of the Royal Gardens at Kew, I have obtained a tracing of the type of the latter plant which confirms the suspicion. Besides the type from Aguas Calientes, South Mexico, it has been collected in the State of Jalisco, at Guadalajara, by Dr. Palmer, no. 280, July–October, 1886, and by C. G. Pringle, in copses near Guadalajara, no. 5432, Aug., 1893. Mr. Hemsley (Biol. Centr. Am. **2**: 358) also quotes a specimen without locality from Herb. Pavon as belonging to this species. The specimens distributed as *Enslenia ligulata* by Pringle (no. 4494) and *Ampelanus ligulata* by A. A. Heller (no. 1899) are species of *Roulinia*.

II. THE TYPES OF GONOLOBUS MICHAUX AND DESCRIPTIONS OF NEW SPECIES IN VINCETOXICUM WALTER

The types of the three species of *Gonolobus* (Michx. Fl. Bor. Am. **1**: 119) are preserved in the Herbarium of the Museum in the Jardin des Plantes, Paris, where they are represented by several specimens each, all in a somewhat fragmentary condition, though quite recognizable and agreeing with the descriptions. In the Richard Herbarium (Herbarium of M. Drake del Castillo, Paris) the actual specimens owned and described by Richard in the Fl. Bor. Am. can be seen and they are in every way exact duplicates

of the plants in the Michaux Herbarium proper, but are apparently more carefully labeled and named than those in the Museum. These last were annotated by Dr. Gray. The first sheet there has as inscription "*Cynanchum macrophyllum capsulis angulosis*" and is apparently the plant previously named *Vincetoxicum gonocarpos* Walt. and the plant which Dr. Gray (Proc. Am. Acad. **12**: 75) recognized as *Gonolobus laevis* var. *macrophyllus*. The specimen in the Richard Herbarium has the name "*G. macrophyllus*" and habitat "*In silvis Caroliniae*" on the sheet and is the same plant as the one in the Herb. Michaux.

The second species, *Gonolobus hirsutus*, is more difficult of determination as of course I was not able to make a dissection of the flower and the species is not so readily recognized as the first. There are muricate follicles in both collections and in Herb. Richard two racemes, one dark purple and the other very faded, dull greenish and shrunken; the leaves are large and the plant could be referred as readily to *G. Carolinensis* as to *G. hirsutus*. It is apparently identical with the plants that have been named *G. hirsutus* var. *flavidulus*. (See plants collected by Dr. Mellichamp at Bluffton, S.C., and so named by Dr. Gray). Since seeing these types, I have examined a long series of the *G. hirsutus* and var. *flavidulus* and also *G. Carolinensis* and have come to the conclusion that it will take very critical study and much more material, especially fresh material, to determine whether there are really two species there or only one. The coronal characters are difficult to reach in the dried plants and in the specimens which have passed through my hands I have found every form of crenation, both regular and irregular and great variation in the thickness of the crown-margin and also numerous instances in which the thickened alternate crenations have a very pronounced horn-like process within. Sometimes these last characters showed themselves in all stages of development from a faint obscure ridge near the apex of the crown-segment to a sharply incurved tooth. These again were to be found on one or two of the segments and again on every one of them. So far as I have been able to note, these characters are constant on the same plant. In some specimens the crown is uniformly thin, entirely lacking the alternate thickened divisions of the descriptions, others again have the thin geminate teeth

claimed for *G. Carolinensis* and the quadrate alternate divisions belonging to *G. hirsutus*. It seemed entirely impossible with the material at hand to draw any fast or hard line between them. The pollinia that have very marked characters in the other species seem to be about the same in these two species and I could not find any differences between those of the flowers labeled *G. hirsutus* and of those called *G. Carolinensis*.

These two Michauxian species constituted the older genus *Vincetoxicum* of Walter which leaves the third species *G. laevis* as the type of the genus *Gonolobus*.

The type of *Gonolobus laevis* is somewhat of a curiosity. There is quite a good deal of it, small pieces mostly, but all of the specimens in the two collections agree and point unmistakably to the plant since called *Enslenia albida* Nutt. (*Ampelanus albida* Britt., Bull. Torr. Bot. Club, **21**: 314). In the Michaux Herbarium there are on a sheet a small specimen of *G. suberosus*? (the name and query are in Dr. Gray's* handwriting), one angled follicle and one raceme, noted as *G. laevis*, also by Dr. Gray, and two more leaves and two follicles. The old labels read "*Cynanchum capsulis laevis*" and "*Gonolobus laevis, Illinois.*" In the Richard Herbarium the specimens, consisting of some leaves and one angled follicle, are much worm-eaten. They are all, except the fragment of *G. suberosus*, *Enslenia albida*. This will clear up the discrepancy of the original description of *G. laevis* with the plants that have passed as such. "*Foliis quasi conoideo-cordatis, sensim acutis nervis tantum minutissime puberulis*" describes certainly the leaves of *Enslenia albida*, but scarcely accurately those of the so-called *Gonolobus laevis*. The synonymy of this plant should therefore be as follows:

GONOLOBUS LAEVIS Michx. Fl. Bor. Am. **1**: 119. 1803

Enslenia albida Nutt. Gen. Am. **1**: 164. 1818.

Ampelanus albidus Britton, Bull. Torr. Bot. Club, **21**: 314. 1894.

* *Gonolobus suberosus* and *G. macrophyllus* are very close in general appearance, though the former has commonly yellowish-green leaves, with truncate base, and the latter darker green leaves that have notably large rounded basal and often overlapping lobes.

The type of this species is from Illinois, where it is not infrequently met with on river-banks and in thickets. It has a wide range, eastward and southward. The specimen quoted from Washington, D. C., as *Vincetoxicum gonocarpos laevis* in Britton & Brown, Illustrated Flora, **3**: 18, is in fruit and is the true *Gonolobus laevis* Michx. (Herb. Columbia University).

A second species **Gonolobus volubilis** (*Nematuris volubilis* Turcz. Bull. Soc. Nat. Imp. Mosc. **21**: 254. 1848. *Enslenia volubilis* Karst. Fl. Columb. **2**: 117. Pl. 162. 1866) occurs near Pt. Cabello, U. S. of Colombia.

VINCETOXICUM SUBEROSUM (L.) Britt., Mem. Torr. Bot. Club, **5**: 266. 1894.

Cynanchum suberosum L. Sp. Pl. 212. 1753. Dill. Hort. Elth. 300. *pl. 229. f. 296*, excluding Hort. Cliff. and Gron. 27.

Gonolobus suberosus R. Br. Ait. Hort. Kew. ed. 2, 82. 1811.

Dr. Gray * has written the history of this species and in addition to his notes it may be of interest to point out that the plant "*Apocynum scandens fruticosum fungoso cortice Brasilianum.*" Herm. Parad. 53 is probably the plant since referred to *Ibatia*, and is not the specimen of the Hortus Cliffortianus which resembles it only as to the corky, ridged bark of the stems. The Cliffort plant can be seen in the Herbarium of the British Museum and is difficult to identify as it is a mere fragment, but the character of the stem should make it easily recognizable were there more available material of the same species for comparison.

I venture to describe the following species as new.

Vincetoxicum Floridanum.

Puberulent throughout. Stems very slender, hirsute with few short, scattered hairs: leaves opposite; petioles 5–20 mm. long, angled; blades ovate, 2–5 cm. long, cordate, tapering to the acuminate apex, the basal lobes rounded, with open sinus, about equally puberulent with a fine soft pubescence on both surfaces; midvein obscurely bi-glandulose at the base above: racemes about the length of the petioles; pedicels 12 mm. long: calyx very small; segments 2 mm. long, linear-lanceolate, with a subulate gland in each sinus: corolla dull greenish-purple, 5-parted to a little below the

* Proc. Am. Acad. **12**: 75. 1876.

middle; segments linear-lanceolate, acute, 3–5 m. long, somewhat fleshy, minutely puberulent, on the outer surface, glabrous within; crown red-purple, saucer-shaped, with 5 broad undulations each bidentate at the callous thickened apex, and a smaller tooth on each side below the middle: stigma depressed, not 5-angled: pollinia oblong, the caudicles broad and apparently not twisted? Follicles not seen.

East Florida: Dr. Leavenworth.

The specimen from which this description has been drawn is in the Herbarium of Columbia University and was labeled by Dr. Torrey, *Gonolobus "macrophyllus."* It was seen by Dr. Gray when he was working on the Asclepiadaceae for the Synoptical Flora and bears his note to the effect that it has "short denticulate lobes" and on the Synoptical Flora label the doubtful one of "seemingly *Gonolobus Carolinensis.*" It differs however from that species, as elsewhere ticketed by Dr. Gray in its much smaller, greenish flowers, and the crown which has not the regular divisions of that of *Vincetoxicum Carolinensis*, but especially in the inflorescence which is irregularly racemose, whereas that of *V. Carolinensis* is more cymose and much longer pedicelled.

Vincetoxicum crenatum

A twining vine. Stems somewhat angled, papillose-puberulent and retrorsely hirsute with scattered short hairs: leaves opposite, on slender, striate, 3–5 cm. long petioles; blades yellowish-green, 6–9 cm. long, ovate, rather long-acuminate at the apex, cordate, basal lobes rounded with open or closed sinus, papillose-puberulent on both surfaces, paler beneath: inflorescence sub-corymbose; peduncles 5–8 cm. long, 4–10-flowered; pedicels slender, 8–15 mm. long, 1–2 bracteolate at base: calyx-segments ovate, acutish, puberulent outside, ciliate, glabrous, and with a subulate gland in each sinus within: corolla 13–14 mm. long, dull yellowish purple, rotately spreading, ovate-conic in bud; segments linear-oblong, acutish, puberulent outside, glabrate within and vertically reticulated, sparingly and minutely hirsute below the sinus, transversely wrinkled and glabrous in the short tube: crown shallow, saucer-shaped, 5-crenate; lobes rounded, not exceeding the anthers, each with a short, barely free internal process or appendage at about the middle; process truncate at the apex: stigma 5-angled, not depressed: anther-appendages small, fleshy; pollinia obliquely semi-orbicular, saccate and broader at the summit, dented at the angled base, caudicles and corpuscles short. Follicles not seen.

Mexico: Barranca near Cuernavaca, State of Morelos, Pringle, no. 6388, July 27, 1895.

Distributed as *Gonolobus pilosus* Benth. Resembling in habit *Gonolobus angustilobus* Rob. & Greenm. (Proc. Am. Acad. **29**: 388. 1894) from the State of Jalisco, but differing in its yellowish-green foliage, the more numerous flowers and the curiously reticulated character of the corolla. The leaves of *G. angustilobus* are grayish-green, the flower appears to be solitary and the corolla is not at all reticulated. Detailed floral characters of this last species, owing to lack of material, are not accurately known.

In regard to the true *Gonolobus pilosus* Benth. (Pl. Hartw. 289. 1848) it is perhaps worth noting that a specimen collected by Dr. Coulter, in Mexico, no. 975, is preserved in the Herbarium of Columbia University. This number is quoted by Hemsley (Biol. Centr. Am. **2**: 333) as belonging to *Gonolobus pilosus* Benth. It coincides in every respect with the description of that species. The flowers are at least 3.5 cm. in diameter when open, and are of a dark, dull reddish-purple. The calyx-segments and bracteoles are over 13 mm. long, ovate, acutish and foliaceous. The crown is barely 5-parted, lacerate-denticulate along the whole margin, each division with an adnate, thickened internal appendage which is laciniate and barely free at the broadly quadrate summit. The pollinia are remarkably large, obliquely oblong, rounded at the base and somewhat saccate, slightly tapering to the curved caudicles; corpuscle broadly obovate at the apex, abruptly contracted to the much narrower rounded base. The hyaline anther-tips are conspicuously large.

Vincetoxicum Greggii

Gonolobus productus Torr. Mex. Bound. Surv. 165. 1859. In part.

A slender, twining vine. Stems minutely puberulent and hirsute with short scattered hairs: leaves opposite; petioles 5–15 mm. long; blades 1.5–3 cm. long, or more, ovate-hastate, long-acuminate at the apex, the basal lobes rounded with open sinus, rather thick, papillose-puberulent on both surfaces: inflorescence subcorymbose; peduncles 1.2 cm. long, 5–8-flowered: calyx 2 (?) mm. long, minutely hirsute; segments ovate-triangular, acute, with a subulate gland in each sinus: corolla subrotate, 6–7 mm. long;

crown 5-parted, to below the middle; segments thick and fleshy, broadly rounded at the apex, each with an internal ligulate horn or process arising from near the base, exceeding the anthers and incurved over them: stigma 5-angled: pollinia quadrate on slender, winged caudicles, corpuscle narrowly oblong. Follicles not seen.

"Slender vine-like plant, flower purplish," Cadena, Mexico, Dr. Gregg, May 8, 1847.

The specimen described here is in the Herbarium of Columbia University and was included by Dr. Torrey in his description of *Gonolobus productus* and was ticketed under that name by Dr. Gray when he revised the Torrey Collection for the Synoptical Flora. It is closely allied to **Vincetoxicum acuminatum** (*Gonolobus acuminatus* A. Gray, Proc. Am. Acad. **21**: 399. 1888–6) as well as to **V. productum** (*Gonolobus productus* Torr.) All three species belong in Dr. Gray's section *Chthamalia* and without careful dissection could scarcely be distinguished one from the other, except that *V. Greggii* has a more rotately spreading corolla than its congeners.

There are marked differences in the pollinia of the three species. In *V. productum* the pollinia are spreading and perhaps subpendulous, obliquely oblong, twisted (?) and somewhat bent or dented at the middle; the caudicles are apparently winged and the corpuscle is oblong, also appearing as if winged. The pollinia of *V. acuminatum* are more truly horizontal, subovoid, rounded on one side and straight on the other, on broad caudicles, with a broad corpuscle. *V. Greggii* has ovoid-quadrate pollinia, with very slender, somewhat twisted caudicles and a slender oblong corpuscle. In this last species the leaves are smaller than in the two others, the corolla is more rotately spreading, the crown is more deeply parted and the internal ligules are free and incurved over the anthers. The pollinia and crown characters of *V. Greggii* are also nearly those of *Gonolobus bifidus* Hemsley, but in that species the corolla is much smaller and truly rotate. In *V. acuminatum* the crown-segments are quadrate at the apex and the internal processes are short, barely free at the apex.

Contributions to a better Knowledge of the Pyrenomycetes—I: A Study of Miscellaneous Species.

By David Griffiths

(With Plates 365, 366)

The following paper results from a study of a portion of my recent collections in this interesting group of fungi, and consists mainly of species from the Northwest, where the greater part of my collecting has been done. Of the species discussed *Trematosphaera caryophaga* alone was collected east of South Dakota. The other species were either collected in South Dakota, Wyoming, or Montana, or cultivated upon herbage which was obtained from these states.

During my investigations several species have been cultivated which are not recorded here, because of their extreme peculiarity and consequent necessity of obtaining more information regarding them. Some very peculiar modifications have been found in species of the genus *Pleospora*, developed under artificial conditions. In one instance a small quantity of an evident species of this genus developed perfectly superficial perithecia having radiating septate appendages, the whole having much the appearance externally of a perithecium of *Erysibe*. I find that some species of this genus develop very satisfactorily at times after being dried for several months. One immature species collected on dead culms of *Poa Nevadensis* in the Big Horn Mountains in August, 1898, grew nicely on being placed in a moist chamber for a few weeks in March and April, 1899. If some method of inducing more of the *Pyrenomycetes* to become mature could be devised it would be a boon to the collector, for, if the experience of others in the least resembles mine they find about one half of their collections in this group either sterile or immature.

The species of *Sordaria* recorded here are of special interest for several reasons. So far as I am aware, four of them have not been recorded before for this country. If once found they can be cultivated very easily and made use of by the teacher in demonstra-

tions. I know from experience that it is difficult for the young student to form a clear conception of how the asci and spores look within the perithecium although he actually sees them escape from it when it ruptures under the cover glass. With a good condenser one can make out the shape of the asci in these species quite well without rupturing the perithecium at all. This is especially true of such a polysporous form as *S. curvicolla.* I have in several instances been able to secure the perithecia of this species, before they were yet mature, showing one or two large asci protruding above the other younger ones, and having mature spores, while the others had only very young and imperfectly outlined ones within them. As the younger asci develop, the older ones rupture, and their spores escape through the ostiolum, forming a black globule on the top of the perithecium. This is also true, to a less degree, of the two species of *Melanospora.*

Melanospora Poae sp. nov.

Perithecia scattered or gregarious, superficial, thin, membranous, white turning to black and opaque, prolonged above into a curved or twisted beak once to twice the length of the perithecium, covered with long delicate flexuous sparingly septate hairs, 140–180 μ × 500–600 μ: asci broadly clavate, short stipitate, evanescent, without paraphyses, 10–13 μ × 26–30 μ: spores very variable, oblong or cuboidal with an apical grove and often flattened parallel to it, 4.5–5 μ × 5.5–6.5 μ. *Pl. 336. f. 24–26.*

This species has been cultivated on dead culms and leaves of *Poa Nevadensis* collected in the Big Horn Mts., near Buffalo, Wyo., Aug., 1898 (Williams and Griffiths). The culms and leaves were thoroughly moistened and placed in a moist chamber on the 14th of March. Mature perithecia were found on the 29th of the same month—a remarkably short time for the development of this class of fungi. In order to make certain that the perithecia were not already partly developed before the material was placed in the moist chamber, two other cultures were made in April. This time the material was carefully examined, moistened and placed on sterilized filter paper in a Petri dish. Quite a growth of mycelium extended from the culms and leaves over the paper, and the perithecia were again developed entirely distinct from the dead herbage. In neither culture have I been able to find conidia.

There are plenty of Hyphomycetous conidia, especially those of *Cladosporium* and *Alternaria*, but no connection has been traced with any conidial form found on the herbage used. Attempts have been made to germinate the ascospores without success. It is hoped that they will grow later in the season and that pure cultures can then be made.

Melanospora Townei sp. nov.

Perithecia superficial, scattered, thin, membranous, transparent, globular, covered uniformly with long straight or slightly wavy irregularly outlined hairs and surmounted by a cylindrical beak which terminates in a loose aggregation of straight or slightly wavy hairs of unequal length, white turning to light transparent umber and finally black, 225–300 μ in diameter; beak about equal to the diameter of the perithecium and 60 μ in cross-section: asci very evanescent, broadly clavate to obovate, short-stipitate, 8-spored, 30–40 μ × 60–75 μ: spores crowded, olivaceous, becoming dark and opaque, elliptical, 15–17 μ × 20–25 μ; the slightly projecting truncate apices, when viewed endwise, are seen to have a relatively large hyaline pore in the flat truncate ends. *Pl. 365. f. 19–22.*

At my request, Mr. J. R. Towne, of Aberdeen, S. D., sent me fresh material of *Salsola kali tragus* which was affected with various species of *Hyphomycetes*. This material reached me on the 19th of March, when it was placed immediately in a damp chamber and kept thoroughly moistened until the first of June. On the 9th of May the beautiful white perithecia of the above species appeared in abundance.

In about three days after the material was placed in culture there occurred a very luxuriant growth of a species of *Alternaria*. This completely covered the twigs with a dense black layer of spores and hyphae which promised to choke out anything else that might develop. About the 1st of May this ceased to grow and all of the twigs were then covered with a layer of dormant *Alternaria* spores. When the perithecia appeared they were produced perfectly superficial and loose on the top of these masses of spores. I was unable to trace any connection between them and any conidia or distinct mycelium, although some of them grew on the surface of the glass in close proximity to the twigs. All attempts to germinate these ascospores have thus far proved futile.

This species resembles *M. leucotricha* Cda. very much outwardly, except that the perithecia are less hairy and the ostiolum less fimbriated. The spores and asci are, however, decidedly different although about equal in size. Specimens from Rehm's Ascomycetes have slightly inequilateral spores with acute hyaline apiculi. I have not been able to find asci with mature spores in my specimens, but they are common in the European ones. The illustration of the ascus in this paper was made from one in which the spores were just beginning to change color, because of my inability to get the asci with perfectly mature spores out of the perithecia without rupturing them. In fact the asci of this species are much like those of *Sordaria curvicolla* as regards persistency. I have often found immature asci in perithecia which had a globular mass of mature spores on the ostiolum, showing that there is a succession of development correlated, I judge, with the large size of the fully formed asci as compared with that of the perithecium. Some of the asci become mature, rupture, and allow their spores to escape, thereby giving room for other younger asci to develop.

SORDARIA MINUTA Fckl.

Perithecia superficial, scattered, thin, membranous, white to fuscous, and so transparent that the spore-bearing area which occupies rather less than half the length of the perithecium can be readily distinguished, covered with short septate agglutinated hairs which are more prominent around the smooth, black, naked, conical, erect or curved apex, 140–180 μ × 360–510 μ: asci paraphyseate, cylindrical, with a contracted stipe one half the length of spore-bearing portion, 4-spored, 15–18 μ × 100–110 μ: spores monoseriate, elliptical, acutely pointed, olivaceous to black and opaque when mature, 13–14 μ × 16–22 μ, terminating below in a hyaline straight or slightly curved gelatinous appendage one half the length of the spore. *Pl. 365. f. 10–12.*

The asci are without exception 4-spored and uniseriate. Dr. Winter (Die deutschen Sordarien, Abhand. der Naturforsch. Gesell. zu Halle, **13**: 67–107. 1887) characterizes this species as having 4- or 8-spored asci. But he also finds in many of his collections and cultures of German specimens that one or the other form is quite constant, while in still other material the two forms are mixed.

Dead culms and leaves of *Poa Nevadensis* having on them

imperfectly developed perithecia of some of the *Sphaeriales*, probably a *Pleospora*, were collected in the Big Horn Mts., near Buffalo, Wyo., at an altitude of about 8000 ft. in August, 1898 (Williams and Griffiths). On the 14th of April, 1899, this material was thoroughly soaked and placed in a moist chamber. On the 3d of May mature perithecia of the above were present in considerable numbers. They continued to develop for two weeks longer when the material became dry. No precautions were taken regarding heat and moisture, the culms and leaves being cut into appropriate lengths to fit in an ordinary 3½-inch Petri dish, thoroughly moistened, and kept at laboratory temperature of about 21° in another Petri dish of larger size.

SORDARIA CURVULA DeB.

Perithecia scattered, superficial but firmly attached by the base, conical, truncate, curved and blackened at the apex, thin, membranous, sparingly covered with septate fasciculated hairs which are more prominent around the base of the blackened apex, 275–375 μ × 500–700 μ, spore-bearing area easily distinguished by transmitted light, asci paraphyseate, cylindrical-clavate, stipitate, 8-spored, 25–35 μ × 160–200 μ: spores biseriate with the two lower spores of the upper series overlapping the two upper spores of the lower series in the center of the spore-bearing portion of the ascus, oval, 19–21 μ × 24–28 μ, abruptly but acutely pointed, olivaceous to black with a gelatinous hyaline appendage at the lower end varying from one half to once the length of the spore. *Pl. 365. f. 1–5.*

This differs in several particulars from *S. curvula aloides* Wint. as recorded for this country by Messrs. Ellis & Everhart in N. A. Pyreno. 129, and corresponds more closely with the typical European species. The main differences occur in the characteristics of the hairs and the serial character of the spores. When the asci escape from the perithecium under the microscope they often appear distorted, becoming inflated so as to render the ascus more or less oval in outline, but leaving the arrangement of the spores undisturbed. I have had this phenomenon occur in water, 2 % chrome-alum, and 5 % caustic potash. Dr. Winter describes and figures a similar phenomenon in his specimens.

Dead stems of *Salsola kali tragus* affected with a species of *Ophiobolus* were collected at Aberdeen, S. D., in March, 1898. On the

10th of March, 1899, these stems were placed in a moist chamber under conditions similar to those described above for *Poa Nevadensis*. Mature perithecia of this species were first observed on April 7th. Subsequent cultures from the same material show the perithecia to develop in about three weeks. It appears to thrive best in an abundance of moisture. I have succeeded in getting the best growth of it when the herbage was not only thoroughly moist but when the chamber in which they were placed had water standing in the bottom of it. This species has also been cultivated in small quantity on dead scapes and leaves of *Allium* from the Big Horn Mountains of Wyoming, treated in the same way.

SORDARIA CURVICOLLA Wint.

Perithecia scattered, semi-immersed, pyriform, thin, membranaceous, about 600 μ in diameter, outline of asci plainly distinguishable by transmitted light, the conical truncate black apex clothed with short, delicate, simple, brown hairs, asci broadly clavate, polysporous with few evanescent paraphyses, 100–120 $\mu \times$ 270–300 μ: spores oval, 10–11 × 14–15 μ, olivaceous to dark and opaque with a hyaline appendage at the lower end about $\frac{2}{3}$ the length of the spore. *Pl. 365. f. 13–15.*

This species developed on *Salsola kali tragus* with *Sordaria curvula*, but I found none of it for about five weeks after the culture was started.

This differs from European specimens principally in the larger number of spores and their occasionally darkened apiculi. The latter is not invariable in my specimens and I apprehend that the former may be very variable in the species. Dr. Winter, after isolating an ascus in one of his specimens and rupturing it, counted 128 spores, but my specimens contain as many as 150 spores, a variation which I consider of minor importance. In other respects my specimens correspond very well with European specimens in Krieger's Fungi Saxonici, no. 33, as they do also with Dr. Winter's descriptions and figures.

I would not be surprised to know that this and the two previously described species are very common in this country although they have not been recorded before so far as I am aware. They are very liable to be overlooked by the collector. Indeed, it is with difficulty that I am able to find the perithecia in my cultures after they have become dry, although they are very numerous.

SORDARIA PLEIOSPORA Wint.

Perithecia scattered, with base slightly sunken in the soft substratum, covered especially above with the characteristic cellular agglutinated hairs of this group, together with a few long, delicate, simple, slightly flexuous, sparingly septate, brown hairs, and terminating in a curved, black, rounded or truncate beak, 450 $\mu \times 600\ \mu$: asci 28–32-spored, cylindrical-clavate, short-stipitate, 30–40 $\mu \times$ 175–200 μ: spores oval, 12–15 $\mu \times$ 18–21 μ, black and opaque with hyaline evanescent gelatinous appendage at lower end, about $\frac{2}{3}$ the length of the spore. *Pl. 365. f. 6–9.*

The measurements of spores and asci given above are considerably at variance with the published descriptions of European forms. The species is also described with gelatinous apiculus at each end of the spore. The number of spores in an ascus is said to vary from 16–64, but my specimens vary within the much narrower limits quoted above. The gravest variations, therefore, are in spore measurements which are given by Winter as 16–19 $\mu \times$ 24–34 μ. The variation in the size of the ascus is not so important in my estimation since the number of spores is so variable.

Associated with these species developed on *Salsola* stems I find an abundance of conidial forms resembling those which Winter found in his cultures. He, however, was unable to trace any connection between these conidial forms and the species of *Sordaria* with which it was associated and simply mentions it as a probable conidial form. He describes the hyphae as short, hyaline, continuous, with a bifurcate apex; and the spores as fusiform with attenuate base and rounded apex, continuous or obscurely uniseptate. In my material the spores are of two distinct forms both of which are evidently polyseptate. One form resembles those described above in everything but the septation of the spores while the other has long spindle-form spores resembling the former but pointed at both ends. Thus far I have found nothing that enables me to make any statement regarding their probable affinities.

SORDARIA FIMICOLA (Rob.) Ces. & DeNot.

This species developed on dead *Eleocharis* culms affected with *Pleospora aquatica* placed in moist chamber for 18 days. As it is described by Messrs. Ellis & Everhart in N. A. Pyreno., 127, it need only be mentioned here. *Pl. 365. f. 16–18.*

PERISPORIUM VULGARE Cda.

Perithecia superficial, scattered or gregarious and more or less angular from mutual compression, subglobose, carbonaceous, brittle, black and shining when mature, covered at first with a white tomentum which soon disappears, about ⅓ mm. in diameter: asci evanescent, broadly clavate, long-stipitate, 8-spored, 15–20 μ × 90–105 μ: spores 4-celled, 6–8 μ × 24–28 μ, brown, opaque, with the two end cells subconical and the two middle ones oblong-cubical, easily separating into separate cells. *Pl. 366. f. 15–18.*

This species is described and figured here for several reasons So far as I am aware, it has not been recorded before from this country, although figured and described by Messrs. Ellis & Everhart from European specimens. The specimens, which I have in good quantity, were collected by Mr. C. W. Williams, one of my former students, at Aberdeen, S. D., on sticks and straw in an old rubbish heap, March, 1898.

The ascospores germinate very readily and grow vigorously. The specimens from which the accompanying figures were made were cultivated from the ascospores of the material cited above. Ordinary filter paper was sterilized, placed in a Petri dish and moistened with a sterile decoction of ash leaves, and then inoculated with the ascospores. A delicate white mycelium was produced in abundance in a very few days, but careful search failed to discover any conidia. The perithecia became mature in six weeks. The spores (cells of ascospores) apparently have no regular method of germination, like those of the *Sordariaceae* or *Chaetomiaceae* for instance, but crack open irregularly to allow the promycelium to develop. Although the conditions were apparently favorable for mycelial development the perithecia were few and scattering in my cultures.

Pocosphaeria Allii sp. nov.

Conidial hyphae arising from a much branched torulous, knotted, brown, subepidermal mycelium, variously bent and knotted, 6–8 μ × 150–200 μ: conidia oval, 1–3-septate, brown, minutely echinulate, 11–14 μ × 24–30 μ: perithecia subglobose to hemispherical, 100–125 μ in diameter, erumpent, membranous, dark-colored with a thickened darker ring around the ostiolum; bristles around the thickened ostiolum black, smooth, straight to

recurved: asci cylindrical, contracted below, sessile, usually more or less curved or inequilateral, 12–15 μ × 50–60 μ: spores 3-septate, constricted at the septa, fusiform, brown, 5–8 μ × 16–20 μ. *Pl. 366. f. 1–9.*

On dead scapes and leaves of *Allium brevistylum* in Big Horn Mts., near Buffalo, Wyo., Aug., 1898. (Williams and Griffiths.)

The method of development of the perithecia in this species is of interest. The conidial hyphae usually protrude through the stomata in tufts of 2–5, and the perithecia are developed as a proliferation of the cells at their bases. At first the hyphae arise directly from the hypodermal mycelium which can be easily seen in tangential sections, but the proliferation of cells at their bases soon gives them the appearance of arising from a pseudo-parenchymatous mass of fungous cells. The hyphae are carried upward by this mass of cells, and the stoma and surrounding tissues become much distorted. The hyphae appear to produce conidia for some time after the beginning of perithecial development as shown in the figures. These, however, finally disappear before the perithecium becomes mature, and bristles develop surrounding the central ostiolum. Unfortunately mature material is rather rare, but the conidial and transitional stages have been collected in good quantity.

Pyrenophora Salsolae sp. nov.

Perithecia aggregated, subepidermal, early erumpent, subglobose to flattened, black, carbonaceous, brittle, about 300 μ in diameter, covered uniformly above with short, brown to black, septate, slightly wavy fugaceous bristles: asci cylindrical, contracted below into a short-stipitate base, 3–8-spored: spores one- or two-seriate, ovate, muriform, 4–5-septate with two longitudinal septa, slightly flattened, yellow, 6–11 μ × 20–26 μ. *Pl. 366. f. 30–34.*

The method of spore dissemination in this species is very interesting. There is near the middle of the ascus a transverse marking which is usually plainly visible. Sometimes it is simply a transverse line on the ascus wall, but more often it appears as a spiral of 1½ turns. When pressure is put upon the cover glass, the asci rupture on these markings, the top of the ascus shooting out for some distance, leaving in its wake the spores more or less deranged, but always in a long string imbedded in a gelatinous matrix, which does not remain attached to them when they are

isolated. Often one may find in the field the top and bottom of an ascus separated by twice its original length, and the two parts connected by a string of spores imbedded in their matrix. The rupture of the ascus is brought about doubtless here as in many other ascomycetes by the tension within it, for the gelatinous material with its contained spores occupies two or three times its original volume when set free by the rupturing of the ascus.

This was cultivated on dead stems of *Salsola kali tragus* with the species of *Sordaria* described above. It developed in rather small quantity in eight weeks' time.

Trematosphaera caryophaga (Schw.)

Perithecia superficial with their bases slightly sunken in the thin, black, carbonaceous crust which covers the nut more or less uniformly, rough, black, carbonaceous, brittle, hemispherical, with papilliform ostiolum, 350 μ in diameter, asci evanescent, subcylindrical with filiform paraphyses, 10–12 μ × 55–75 μ: spores biseriate, oblong, narrowed and round at the ends, slightly inequilateral or curved, 3-septate with a darkened band surrounding the middle septum, 4–6 μ × 10–16 μ. *Pl. 366. f. 12–14.*

This species described by Schweinitz, Syn. N. Am. Fungi, no. 1594 Trans. Amer. Phil. Soc. Phila., 215, 1831, has been included by Messrs. Ellis and Everhart, North American Pyreno. 207, with *T. nuclearia* (DeNot) Sacc., published in Micr. Ital. **9**: 462, *f. 4*; but a very little study of the specimens from different localities is necessary to convince one that the American form growing on decaying shells of hickory nuts, is very different from the European form growing on olive pits. Had I but one specimen I might consider the species variable enough to produce the differences which are observable; but the Pennsylvania specimens collected by Mr. Everhart and my own collected in the burrow of some rodent at Fort Lee, New Jersey, are remarkably constant in all their characters, even to the coloration of the spores. The main differences are those of size which are brought out in my figures (10 and 11, *pl. 366*) of these two species. The European species is larger throughout than the American—the perithecia measuring about 525 μ, the spores 6–8 μ × 18–21 μ. I have been unable to get out complete asci from the European specimens at hand (Roumeguère Fungi Selecti Gallici, no. 4783). The colora-

tion of the spores differs markedly also. In the European specimens the spores are darker in color and the central band extends over all of the two central cells, while in the American ones there is a light streak between the dark band and the outside septa. The paraphyses are much less abundant in the European species.

In both species the dark band obscures the middle septum so that it is often difficult to determine whether the spores are really 3-septate or not. I find, however, that after soaking in glycerine for some time the central septum becomes more apparent. Its presence is sometimes indicated by a very slight constriction; in young spores it can be very distinctly seen.

Dothidea conspicua sp. nov.

Stroma immersed, irrumpent, surrounded by the lacerated remains of the ruptured epidermis, circular or oval, seldom confluent, flat, rough, black, 1/3–2/3 mm. in diameter: ascigerous cavities sunken, oval to conical and more or less angular from mutual compression, 50–60 μ × 100 μ: asci cylindrical-clavate, with a short, stout, blunt stipe, without paraphyses, 65–85 μ × 12–14 μ: spores sub-biseriate, unequally uniseptate, constricted, at first yellow, but finally dark and opaque, 5–6 μ × 13–18 μ. *Pl. 366. f. 19–23.*

On *Yucca angustifolia* at Billings, Mont., August, 1898. (Williams & Griffiths.)

Mr. J. B. Ellis described a *Phyllachora? Yuccae* on *Yucca angustifolia* (Bull. Torr. Bot. Club, **22**: 440. 1895) collected by Dr. Egeling at Matamoras, Mexico. I thought at first that my specimen must be the fully developed condition of the immature species which he there describes; but the characteristics of the stroma alone are enough to separate it from the Mexican specimen, which also appears to me to be a *Dothidea.* The absence of paraphyses and the method in which the epidermis becomes ruptured and lacerated are also good characteristics which would separate the above described species from that described by Mr. Ellis. The nearest relative, however, of this species appears to be *Didymosphaeria yuccaegena* (Cke.) Sacc., Sylloge Fungorum, **1**: 708. This was originally described as *Sphaeria yuccaegena* Cooke, in Grevillea, **7**: 12. 1878, from specimens collected by Dr. Harkness on *Yucca communis,* at Sacramento, California. After the change in name made by Saccardo, cited above, Cooke in

Grevillea **18**: 28 wrote the species as *Didymosphaerella yuccogena* Cke. This species also may be a *Dothidea*. It certainly appears to have its asci produced in stromatic cavities without perithecia the same as the species here described; and the spores have the typical unequal septation of the genus *Dothidea* when young, but they become more nearly equal when mature. In the general appearance of asci and spores there is but little difference between this species and the one which is described above. A specimen in the Ellis Herbarium from Dr. Harkness shows the spores to be larger and the asci nearly twice the width at the base. These are the only differences in the microscopic characters. The method of growth is, however, decidedly different. The stromatic areas in my species are two to three times as large, prominently erumpent and surrounded by the lacerated remains of the ruptured epidermis; while in the other case the epidermis is unruptured although the specimens appear to be as fully developed as mine.

Pleospora aquatica sp. nov.

Perithecia scattered, subglobose to hemispherical, 140–180 μ in diameter, flattened when dry, subepidermal, remaining covered, membranous, black and smooth with flat indistinct ostiolum: asci cylindrical-clavate, curved, and often bent into a u shape, short-stipitate, without paraphyses, 22–29 μ × 95–125 μ: spores oval, 10–12 μ × 28–30 μ, slightly flattened, with 5 transverse and 2 to 4 longitudinal septa, constricted at all transverse septa and surrounded by a gelatinous hyaline covering which is prolonged into a short thick blunt appendage at either end. *Pl. 366. f. 27–29.*

This species was collected at Aberdeen, S. D., in May, 1896, on dead stems of *Eleocharis palustris* under water. The pond in which the collection was made, had been filled with artesian well water together with that obtained from natural drainage to a depth of not less than a foot since the previous season. I first discovered the fungus in April when it was immature. About a month later I visited the same locality again and found an abundance of it in the best condition possible. The pond contained from 2 to 2½ feet of water during the spring months and the culms of the previous year upon which the fungus grew were entirely submerged.

COLUMBIA UNIVERSITY, 1 July, 1899.

Explanation of Plate 365

1–3. *Sordaria curvula* DeB. Perithecium, ascus and spore.

4 and 5. *Sordaria curvula* DeB. Two germinating spores after 24 hours in water.

6–8. *Sordaria pleiospora* Wint. Perithecium, ascus and spore. Spores in ascus slightly deranged.

9. Hair from perithecium of *S. pleospora*.

10–12. *Sordaria minuta* Fckl. Perithecium, ascus and spore.

13–15. *Sordaria curvicolla* Wint. Perithecium, ascus and spore.

16–18. *Sordaria fimicola* (Rob.) Ces. & DeNot. Perithecium, ascus and spore.

19–21. *Melanospora Townei* sp. nov. Perithecium, ascus and spore.

22. Hair from perithecium of *M. Townei*.

NOTE.—All perithecia × 35, asci 230, and spores 315. Figs. 4 and 5 × 230; 9 and 22 × 315.

Explanation of Plate 366

1–9. *Pocosphaeria Allii* sp. nov.

1. Mature perithecia, × 50.

2. Young perithecium crowned with the conidial hyphae, × 230.

3. Conidial hyphae showing a slight proliferation of cells at their bases, × 230.

4. A single hypha projecting through a stoma, × 230.

5. Ascus, × 230.

6. Spore, × 315.

7. Conidiospores, × 315.

8 and 9. Mycelium as seen through the transparent epidermis, × 230.

10 and 11. *Trematosphaera nucleiara* (DeNot.) Sacc. from Roumeguère Fungi Selecti Gallici, no. 4783.

10. Perithecium, × 35. 11. Spores, × 315.

12–14. *Trematosphaera caryophaga* (Schw.).

12. Perithecium, × 35. 13. Ascus, × 230. 14. Spores, × 315.

15–18. *Perisporium vulgare* Cda.

15. Perithecium grown on paper in Petri dish, × 75.

16. Ascus, × 230. 17. Spores, × 315. 18. A single cell of ascospore after 24 hours' growth in water.

19–23. *Dothidea conspicua* sp. nov.

19. Portion of affected *Yucca* leaf, × 12. 20. Ascus, × 315.

21. Portion of a stoma, × 35. 22. Spore, × 315. 23. A stromatic cavity showing cellular structure, × 230.

24–26. *Melanospora Poae* sp. nov.

24. Perithecium, × 50. 25. Ascus, × 315. 28. Spores, × 480.

27–29 *Pleospora aquatica* sp. nov.

27. Perithecium, × 35. 28. Ascus, × 230. 29. Spores, × 315.

30–34. *Pyrenophora Salsolae* sp. nov.

30. Perithecium, × 35. 31. Two asci, one of which shows the spiral line of dehiscence. 32. An ascus slightly extended after rupturing. 33. Two asci, one of which shows a straight line of dehiscence. All × 230. 34. Spores, × 315.

Studies in Sisyrinchium—IV: S. angustifolium and related Species of the West and Northwest

By Eugene P. Bicknell

The simple-stemmed blue-flowered *Sisyrinchia* of the far west and northwest which have hitherto been referred mostly to *S. angustifolium* Miller in reality represent a group of distinct species. This appears unmistakably from a considerable collection of specimens brought together from various sources; but it is further evident from this same material that, largely by reason of its general deficiency in specimens with mature fruit, it forms a wholly inadequate basis for the confident segregation of the various forms.

The problem presented therefore is the reduction of this inchoate mass into some approach to natural order under conditions which make impossible a final and satisfactory result. In order to take any forward step in these circumstances it is necessary to proceed in great part on the individual judgment pending the final proof which a sufficient series of specimens can alone afford. Under the risk of error involved in thus attempting the disentanglement of the species, I have aimed rather to avoid the creation of any mere synonym than to define the exact nature of the differences between the forms recognized, whether varietal or fully specific. And a number of forms have been passed over entirely as appearing to have too uncertain claims to possible specific rank.

Sisyrinchium Idahoense sp. nov.

From 20–45 cm. high, pale green and glaucous, usually showing some discoloration in drying. Leaves from half to three quarters the height of the stem, grass-like, varying from thin and somewhat lax to firm and closely erect, and from 1–3.5 mm. in width, attenuate to somewhat abruptly acute, the edges serrulate or smooth: stem straight and erect or somewhat flexuously curved, frequently twisted, simple or occasionally bearing a leaf near the top subtending one or two short branches, 1–3 mm. wide, winged, the edges sometimes smooth but usually distinctly serrulate, or even hispidulous-aculeolate: spathes often deflected, green or faintly purplish, long and relatively narrow, the keels of one or

both bracts often serrulate or hispidulous; outer bract 3–6 cm. long, commonly ¼–⅓ longer than the inner one, rarely twice its length, foliaceous and abruptly pointed or more slender and attenuate, the margins below narrowly hyaline, united for about 4 mm. at base; inner bract 2–3.5 cm. long, herbaceous, the margins narrowly hyaline, obtusely pointed or acute; interior scales mostly about ¾ the length of the inner bract; the spathes, when borne on branches, are shorter with less prolonged outer bract than when terminating the main stem: flowers 3–6 on erect pedicels 1.5–3 cm. long, deep violet-blue, with rather small yellow eye, large, perianth 12–18 mm. long, indicating an extreme spread of over 3.5 cm.; stamineal column 5–8 mm. high; ovary glandular puberulent: capsules globose or ovoid, 4–6 mm. high, rather thick-walled, turning dark; seeds (immature) irregularly obovoid, angled, rugulose, stipitate, about 1 mm. in longer diameter.

Idaho, Washington, Oregon and California. Meadows and moist grassy places, flowering in northern Idaho from the middle of May into July, in western Oregon about a month earlier.

Idaho: Kootenai Co., J. B. Leiberg, Geo. B. Aiton; Latah Co., L. F. Henderson; Nez Perces Co., J. H. Sandberg.

Washington: Whitman Co., A. D. E. Elmer, C. V. Piper; Chehalis Co., A. A. & E. Gertrude Heller.

Oregon: "Eastern Oregon," L. F. Henderson; Crook Co., J. B. Leiberg; Benton Co., A. Isabel Mulford.

California: Mt. Shasta, 6000 ft. alt., Geo. Engelmann; Yosemite Valley, H. Mann.

I find the labels on specimens of this plant variously inscribed with the names, *S. angustifolium*, *S. anceps*, *S. mucronatum* and *S. bellum*. On one sheet all four names appear in different handwritings, well illustrating the confusion that has prevailed in regard to the plant.

The species may be taken as the northwestern representative of *S. angustifolium* to which it is nearly related, differing in its typical state mainly in more ciliolate-serrulate stems, longer spathes with less unequal, more foliaceous bracts and much larger flowers; it is also, as a rule, less stiff and straight, the stems often somewhat curved; the spathes frequently deflected and enclosing longer membranous scales than in *S. angustifolium*. In the usual state of the latter the wings of the stem are manifestly widened into the base of the spathe; in *S. Idahoense* they are scarcely, if at all, so

widened, but may be even slightly narrowed conformably with a joint-like transverse constriction where the raised line of the stem disappears as if pinched out below the base of the spathe. Suggestions of this character casually appear in *S. angustifolium* in which, however, as a rule, the raised line of the stem passes uninterruptedly into the stiff erect spathe.

Stouter, broader-leaved forms of *S. Idahoense* appear somewhat intermediate in aspect between *S. angustifolium* and *S. littorale* Greene, of Alaska. From the latter, however, the species differs essentially in its larger flowers and smaller fruit; it is also less stout, paler and more glaucous, with narrower leaves of thicker texture and less foliaceous and differently shaped inner bract.

The type specimens from northern Idaho, Nez Perces Co., have rather long and broad thin leaves, long foliaceous bracts and very large flowers. The capsules are 4–6 mm. high, and mostly obovate-subglobose often contracted to a substipitate base. Most specimens from Idaho and some from Washington agree closely with these, although other specimens are much slenderer and with smaller flowers. Some specimens from Oregon and Washington, somewhat doubtfully referred here, bear two peduncled spathes and have stiffer leaves, shorter often purplish spathes, apparently smaller flowers and rather larger more globose fruit on slightly more exserted pedicels. Other specimens, from western Oregon are noteworthy from having dried uniformly dark and for their long often flexuous and branched stems, and rather small somewhat obovate fruit. The specimens cited from California are both in poor condition, and though appearing somewhat aberrant are certainly nearer to *S. Idahoense* than to any other species now known.

Sisyrinchium occidentale sp. nov.

Mostly over 20 cm. high (15–35 cm.), stiff and erect, glaucescent to pale glaucous green, usually with a yellowish tinge, discoloring slightly in drying; roots clustered, usually coarsely fibrous. Leaves 1–2.5 mm. wide, firm and erect or sometimes thinnish, strongly or rather weakly close-nerved, very acute, the extreme tip often hardened in age, the basal remains of older leaves frequently becoming bleached and silvery: stems stiffly erect, usually much longer than the leaves, 1–2 mm. wide, wing-margined, the wings usually closely few-striate, the edges like those of the leaves

very smooth, a slight transverse constriction just below the spathe: spathes erect or slightly deflected, green or faintly dull purplish, the bracts often thin and rather weak-nerved, the outer one mostly straight, the inner one more or less convex in outline; outer bract surpassing the inner 2–15 mm., mostly 2–3 cm. long, attenuate-acute, hyaline-margined below and united-clasping for 2.5 mm. at base; inner bract rather broadly hyaline-margined nearly to the apex, sometimes acuminate but usually broad above and abruptly acute or even scarious obtuse; interior scales rather broad, often nearly equaling the inner bract: flowers 3–6, medium to large, deep violet-blue on erect exserted pedicels; perianth 10–14 mm. long; stamineal column 4–6 mm. high; capsules (not fully mature) subglobose, brown, about 4 mm. high, apparently rather few-seeded, and glabrate or nearly so at maturity.

Idaho and Nevada to Colorado and North Dakota, flowering in June and July.

Idaho: Arco, June 18, 1893, Dr. Edward Palmer; Pleasant Valley, June 25–30, 1891, G. N. Allen.

Nevada: Pleasant Valley, May, 1865.

Utah: Supply Creek, July 29, 1875, 9000 ft., L. F. Ward; Salt Lake Valley, July, 1888, J. H. Paul; Bear River Cañon, Aug., 1869, S. Watson.

Colorado: Hot Sulphur Springs, Middle Park, Aug. 1, 1881, Geo. Engelmann; Twin Lakes, July 6, 1896, Biltmore Herb.

Montana: West Gallatin River, June 9, 1883, F. Lamson-Scribner, no. 271, "moist banks"; Helena, June, 1888, F. D. Kelsey.

Wyoming: F. Tweedy; Yellowstone National Park, Mrs. Moore, 1894; Mammoth Hot Springs, 6000–7000 ft., June 4, 1894, F. H. Burglehaus; May, 1889, 6600 ft., F. W. Dewart; North Platte, "wet sandy bottom," July 25, 1858; Jackson's Hole on Snake River, June 18, 1860, F. V. Hayden, "gravelly bottoms. 6000 ft.;" Ft. Bridger, July, 1873, T. C. Porter.

A species resembling forms of *S. augustifolium* but evidently distinct, and probably not distantly related to *S. halophilum* but usually much stouter and taller and with much larger flowers. It differs from *S. angustifolium* mainly in much less elongated outer bract and larger interior scales, more narrowly winged stem, constricted below the frequently deflected spathes, larger flowers and apparently smaller fewer-seeded capsules. The material at hand,

however, is inconclusive as to the exact character of the mature capsule and seeds.

Certain small specimens, imperfect as to flowers and fruit, appear somewhat intermediate with *S. halophilum*, but the fully developed states of the two plants show them to be distinct. From *S. halophilum* the present species differs in brighter green color, less thickened roots, broader leaves and stem, the latter more decidedly winged, larger spathes with more unequal and acute bracts, larger flowers on more slender pedicels, larger and darker glabrate capsules.

Several small specimens from the Mammoth Hot Springs with mostly curved stems, and leaves very variable in length and breadth are referred here with some hesitation. A single specimen from North Dakota is old and fragmentary but at present can be placed with no other species than this. In fact I am obliged to make this species for the present a repository for a somewhat ill-assorted series of specimens which may represent more than one species but which it is impossible to place satisfactorily wanting a better knowledge of their flowers and mature fruit.

Sisyrinchium segetum sp. nov.

Duller green and less glaucous than *S. occidentale*, even scarcely glaucescent, with narrower and thinner leaves and more numerous and narrower stems apparently growing close together in dense masses rather than tufted: leaves mostly setaceous and 1 mm. wide (.5–1.5 mm.), not very close-nerved except when young, sometimes roughish toward the tapering aculeate often bent apex: stems mostly 1 mm. or less wide, the narrow wings thin, with almost hyaline edges: spathes mostly purplish to red-purple, sometimes nearly green, stiffly erect, the outer bract very slenderly attenuate sometimes for fully half its length, tapering acute, 18–38 mm. long, subequal with the inner bract or surpassing it by 12 mm., or even more, the inner bract narrower, more slenderly attenuate and less hyaline-margined than in *S. occidentale*: flowers on very slender often subspreading pedicels, very large and deep violet-blue, the perianth 12–17 mm. long indicating an extreme spread of over 3 cm., the segments slenderly aristulate; stamineal column 5–7 mm. high; capsules broadly oblong, 5–6 mm. high, brown, transversely corrugate, many-seeded, seeds irregularly obovate, 1 mm. in longer diameter, black, faintly pitted to smooth.

Washington: Seattle, May, 1892, in full flower, Chas. V.

Piper, ex Herb. Young Naturalist's Society, Herb. Columbia University; Yakima region, T. S. Brandegee, 1882, mature fruit, Herb. Mo. Bot. Gard.

Oregon: "Prairies Western Oregon," May, 1880, in full flower, Thomas J. Howell; distributed as *S. bellum* Watson in Howell's "Pacific Coast Plants," U. S. Nat. Herb.

Nevada: Washoe Co., alt. 1500 m., July 21, 1896, mature fruit, F. V. Coville and J. B. Leiberg, U. S. Nat. Herb.

An attractive plant evidently with close affinity to *S. occidentale*; though not actually proved to be distinct by the few specimens before me I feel little hesitation in giving it a name. It appears to be less glaucous than *S. occidentale* with narrower more numerous and crowded leaves and stems of thinner texture, slenderer roots, larger often red-purple spathes and narrower mostly more unequal bracts, the inner one especially more attenuate and acute. The highly colored spathes give the plant much the aspect of forms of *S. mucronatum* of the East.

The sheet of specimens cited from Nevada shows fruiting plants which differ strikingly from the other examples, yet for the present I can refer them nowhere else than here. They are very slender with long somewhat flexuous stems and very narrow deflected spathes having the lower part for about 5 mm. scarcely or not at all broader than the stem.

SISYRINCHIUM HALOPHILUM Greene, Pittonia **4**: 34. 17 Mr. 1899

Very pale dull green and white glaucous, mostly low, 10–20 cm. high, stiff and erect or nearly so, the thickened roots densely clustered: leaves half the height of the stem or longer, stiff and thickish, often slightly curved, 1–3 mm. wide, strongly close-striate, smooth-edged, attenuate, acute, in age developing hard-pointed tips: stem from less than 1 mm. to 2 mm. wide, wiry, ascending or outcurved, margined to narrowly winged, the wings thick and firm, smooth-edged: spathes erect, green, rather flat and sharp-edged, 2–4 mm. wide, the bracts striate, subequal or the outer one slightly prolonged; outer bract 15–22 mm. long, usually somewhat convex, acuminate to a short-pointed mostly obtuse often incurved apex, hyaline-margined, united clasping for 3–4 mm. at base; inner bract more broadly hyaline, abruptly acute to obtuse; interior scales more than half the length of the inner bract: flowers 4–8, small to medium-sized, perianth apparently

becoming 10 mm. long, violet-blue; capsules 2–3.5 mm. high, subglobose, often broader than long, strongly trigonous, or even trilobulate around an impressed base, pale, scabrous-puberulent, on erect, slightly exserted pedicels: seeds few, 1–3 in each cell, large, becoming 1.5 mm. long, rugulose-pitted.

Nevada: Humboldt Wells, July 25, 1893, Edw. L. Greene, Herb. E. L. G.; Diamond Valley, July, 1868; 5500 ft. alt., S. Watson, Torrey Herb. and Herb. Mo. Bot. Gard.

California: Bishop, Owen's Valley, alt. 5000 ft., May 15, 1897, M. E. Jones, U. S. Nat. Herb.

Type specimens from Humboldt Wells, Nevada, which have been kindly sent me by Professor Greene are not closely matched by anything else I have seen and may perhaps represent a specialized halophilous type.

Sisyrinchium leptocaulon sp. nov.

Growing in erect narrow tufts from coarse fibrous roots, rather bright pale green and glaucescent, the spathes mostly dull purplish: stems numerous, very slender, 20–38 cm. high: 1 mm. or less wide, wiry and subterete, slightly constricted just below the spathe, the almost membranous margins very narrow or even obsolete: leaves about half the height of the stem or less, equally slender or sometimes the shorter ones becoming 2 mm. wide, smooth-edged, attenuate, the apex often linear with a thickened corneous tip, which is obtuse or acute: spathes very small and narrow, the base less flattened and more narrowed than in *S. halophilum*, the bracts subequal or the outer one rarely surpassing the inner 8 mm.; outer bract 12–22 mm. long, hyaline-margined to the short and rigid, linear, obtuse prolongation, closely united clasping for 2–4 mm. at base; inner bract hyaline-margined to the very obtuse or truncate scarious apex; longer interior scales sometimes nearly equaling the inner bract, longer and narrower than in *S. halophilum*: flowers 3–9, blue or violet, small, the perianth apparently only 7–9 mm. long, the stamineal-column 3–6 mm. high; pedicels 13–22 mm. long, erect and exserted for about one quarter of their length, usually flattened and margined: capsules very small, 1.5–3 mm. high, often distinctly pyriform though sometimes abruptly contracted at both ends, finely scabrous-rugulose and sparsely puberulent, pale but much purplish-tinged, thinner-walled than in *S. halophilum* and less strongly trigonous: seeds few, only 1–3 in each cell, subglobose or broadly oblong, finely rugulose, 1–1.5 mm. in longer diameter.

California: Near Lake Tahoe, July 20, 1889, J. Ball, Herb. Acad. Nat. Sci. Phil.

Nevada: Deeth, July 14, 1896, E. L. Greene; Ruby Valley, July, 1868, 6000 ft., S. Watson, ex Torrey Herb. and Herb. U. S. Nat. Mus.

Utah: Parley's Peak, 6000 ft., June, 1869, S. Watson, ex Torrey Herb.

Nearly allied to *S. halophilum* Greene, and possibly a variety of that species, although I am inclined to regard it as quite distinct. It is a taller, and more slender plant than *S. halophilum*, of a very perceptibly brighter and more yellowish shade of green and with straighter and more clustered stems; these are long and exceedingly slender with the wings reduced to little more than membranous edges. The narrower leaves are less strongly striate and thickened than in *S. halophilum* and more slenderly attenuate, and are apparently also without the abrupt membranous expansion at the extreme base although narrowly clasping below for a longer distance. The purplish spathes are less flattened and less decidedly two-edged below, the narrower bracts less strongly striate, narrower and usually more unequal, the outer one less convex with longer linear tip, the inner one more abruptly scarious-obtuse; the capsules are smaller, more pyriform, thinner-walled, less strongly trigonous and more rugulose and scabrous-puberulent.

Sisyrinchium septentrionale sp. nov.

Growing in small tufts 10–25 cm. high, pale and glaucous, discoloring slightly in drying. Leaves ½–¾ the height of the taller stems, equaling the shorter ones, stiff and erect, mostly setaceously slender and .5–1 mm. wide, rarely 1.5 mm., finely close-striate, attenuate to an acute point: stems equally slender with the leaves, stiff and narrowly firm-margined, the edges like those of the leaves smooth or, when young, minutely denticulate: spathes small, purplish or green, often partly double, one or more flowers arising from between the short proper spathe and the closely subtending slenderly prolonged outer bract; inner bract 13–20 mm. long, mostly attenuate and acute, the outer one 2.5–4 cm. long, and united-clasping for 2–3 mm. at base; both bracts hyaline-margined; interior scales about ¾ the length of the pedicels; flowers very small, apparently not more than 3–4 on erect pedicels usually shorter than the inner bract; perianth 4–7 mm. long,

acuminate and short aristulate, not retuse, apparently pale rose or violet; stamineal column about 3 mm. high: capsules on firm erect pedicels about 15 mm. long, pale, subglobose, relatively large, 3–5 mm. high.

Assiniboia: Moose Mountain Creek, June 6, 1883, J. M. Macoun, "margins of marshes and streams," just in flower. Herb. Torr. Bot. Club.

Alberta: Near Banff, July 8, 1891, Macoun, in flower and young fruit. U. S. Nat. Herb. and Herb. Mo. Bot. Gard.

Washington: Wilkes Expedition, 1838–42, "Spokane to Colville." U. S. Nat. Herb.

Idaho: Soda Springs, June 21, 1892, A. Isabel Mulford.

Characterized especially by small size, extremely narrow leaves and stems, very small, pale flowers, with the divisions of the perianth non-emarginate, slenderly much prolonged outer bract and relatively large subglobose capsules. Perhaps most nearly related to *S. alpestre*. The specimens from Idaho are without perfect flowers or fruit; though resembling those from British America they have much less elongated primary bract and may not be the same.

Sisyrinchium alpestre sp. nov.

Tufted, becoming 20 cm. high, dull green and glaucous, discoloring slightly when dry. Leaves about half the height of the stem, stiff and erect, .5–2 mm. wide, closely striate-nerved, rather abruptly cuspidate acute, the edges smooth or slightly denticulate above in young leaves: stems slender, 1–1.5 mm. wide, narrowly firm-winged, the edges smooth, distinctly broadened into the base of the spathe: spathes green, narrow, 2 mm. or more wide at base, the outer bract very long and slender, sometimes slightly broadened above the middle, straight or curved, 4.5–6.5 cm. long, surpassing its fellow 2.5–3.8 cm., the margins narrowly hyaline below, united-clasping for 4–6 mm. at base; inner bract 1.8–3 cm. long, narrow and slenderly prolonged, acute, the margins below white-hyaline; interior scales broad, obtuse, about half the length of the fruiting pedicels: flowers on firm erect pedicels 14–18 mm. long, and shorter than the inner bract, small, perianth apparently only 6–10 mm. long, with the divisions not emarginate but narrowed to a short-aristulate tip, faded but appearing white, though in one flower showing the faintest tinge of violet; column becoming 5 mm. long: immature capsules narrowly obovoid-oblong, evidently large and apparently obovoid at maturity, the oldest one 6 mm. long and 4 mm. wide at the top.

Colorado: Como, 9775 ft. altitude, in meadow, Aug. 3, 1895. "Crandall & Cowen," no. 477, Flora of Colorado. U. S. Nat. Herb.

Related to *S. angustifolium*, and perhaps to be referred to an alpine variety of that species, but *S. angustifolium* is also a plant of very high altitudes in Colorado, occurring in a stout and nearly typical form which contrasts notably with the slender plant here described, although more slender Rocky Mountain forms of *S. angustifolium* appear less distinct. An understanding of the true status of the plant must await further material, especially the mature fruit. In any case it is clearly something quite different from the ordinary eastern *S. angustifolium*. In respect of the slenderly prolonged inner bract and small pale flowers with non-emarginate segments the plant shows much similarity to *S. sarmentosum* and in its flowers and general habit to the much smaller *S. alpestre*. It differs from typical *S. angustifolium* in duller gray-green color, greater slenderness, thicker and more closely striate leaves, narrower and more slenderly prolonged bracts which are less strongly nerved and with more hyaline edges, smaller paler flowers with unnotched segments, shorter pedicels, more obovoid-oblong capsules.

S. SARMENTOSUM Suksdorf; Greene, Erythea **3**: 121. 1895.

Tufted or closely massed in growth, 1.5–2.8 cm. high, dull green and glaucescent discoloring in drying: roots slender and numerous: leaves rather thin, erect, equaling the stem or shorter, rather weakly nerved, 1–3 mm. wide, attenuate, acute, smooth-edged or sometimes serrulate when young: stem 1–1.5 mm. wide. narrowly wing-margined, the wings not broadened into the base of the spathe, smooth-edged or obscurely denticulate, erect or somewhat outcurved, simple and leafless, or occasionally developing a terminal node bearing a slender elongated leaf or cluster of several leaves subtending an outcurved peduncle: spathes green, erect or bent forward, narrow, 1–2 mm. wide at base, the bracts foliaceous, thin and somewhat membranous, striate, closely parallel, both narrowly prolonged to the rather abruptly acute or obtusish apex, the outer one 3–6 cm. long, surpassing the inner one 1–2.5 cm., broadened above the middle, the margins narrowly hyaline, united for 3–5 mm. at base; inner bract more than half the length of the outer one, also herbaceously prolonged but narrower and more scarious margined, 2–3.5 cm. long: flowers 1–3, light blue, small,

the perianth 7–10 mm. long, the segments not usually emarginate but abruptly contracted into the short-aristulate tip: stamineal column 4–5 mm. long; pedicels slender, in fruit 1.5–2.5 mm. long, ascending or somewhat spreading from about midway in the spathe: capsules thin-walled, subglobose, transversely corrugate at maturity, 4–5 mm. high: seeds not fully mature, black, finely rugulose pitted, asymetrically obovoid or curved, angled.

Washington, Skamania Co., no. 2233, W. N. Suksdorf, August 31, 1893. "Borders of meadows 2000–3000 ft. altitude." In full flower and fruit.

As remarked by Professor Greene in his publication of this species the fitness of the name given by Suksdorf is not evident. I have examined three sheets of the original collection mounting several good sized tufts as well as separate specimens. The printed label reads "stems sometimes rooting at the nodes," but no evidence of such a character is shown by the specimens, which are simple-stemmed and erect, bearing a node, when at all, only at the top.

The plant is clearly an excellent species. Its very narrow bracts alone, especially the narrowly foliaceous inner one, give it an aspect quite different from that of any other species known to me except perhaps *S. alpestre*, which is amply different in other respects. In the nearest approach to this character of the inner bract ever seen in *S. angustifolium* the herbaceous prolongation is more or less abruptly attenuate, quite in contrast with the linear-prolonged and more foliaceous condition characteristic of *S. sarmentosum*. An approach to this condition, but on a larger scale, is sometimes seen in *S. Idahoense* and *S. littorale*. *S. sarmentosum* differs further from *S. angustifolium* in slender, often curved stems with the wings not widened into the base of the spathe, which is frequently deflected and much narrower, fewer smaller flowers on more slender and spreading pedicels, the segments of the perianth not emarginate, smaller fruit.

SISYRINCHIUM LITTORALE Greene, Pittonia, **4**: 33. 17 Mr. 1899.

Apparently little or not at all tufted, stout, 15–35 cm. or more tall, or sometimes much lower and depauperate, apparently not glaucous, or but slightly so, dull green, turning dark in drying: roots fibrous, slender, mostly spreading from a strong woody axis: leaves 2–4 mm. wide, half the height of the stem or longer,

erect, rather thin and openly striate-nerved, tapering-acute or acuminate, narrowed to both base and apex, the edges mostly roughened, the inner margins below white-scarious; stems stout, simple, rarely bearing a terminal leaf subtending an erect peduncle, 2–3 mm. wide, prominently winged, the wings with thin serrulate edges, not broadened into the base of the spathe and showing a slight transverse constriction at the top: spathes green, erect, or slightly deflected, 4–6 mm. wide, flat, the bracts foliaceous; primary bract 3.7–8 cm. long, surpassing the inner bract mostly 1–4 cm., only exceptionally twice its length, very gradually narrowed to the acute or obtuse pointed apex, the inner margins below narrowly white-hyaline, united for about 5 mm. at the base; inner bract 2.3–4.8 cm. long, often of nearly equal breadth throughout below the abruptly somewhat obtuse apex, or occasionally narrowly prolonged; interior scales narrow, much shorter than the inner bract: flowers few, 1–4, on pedicels mostly a little shorter than the inner bract, large, deep violet-blue with an orange-yellow eye, the perianth 12–14 mm. long; anthers relatively small; stamineal column about 6 mm. high: capsules large and thick-walled, dark, obovoid or subglobose, 6–8 mm. high, on erect or slightly spreading pedicels 1–2 cm. long: seeds globose, 1.5 mm. in diameter, black, rugulose-pitted almost to maturity when nearly smooth, the umbilicus usually appearing as a mere cleft.

Grassy beaches and shores, coast of Alaska, beginning to flower in late June and early July, fruit ripe in August. So far as known, restricted to the southern Alaskan coast and the only species of *Sisyrinchium* occurring in that territory. Shores of Yes Bay, July 3, 1895, Thos. Howell, no. 1662; Back Bay, July 3, 1895, M. W. Gorman; shores of Behm canal, Aug. 3, 1894, M. W. Gorman; Sitcha, Ferd. Bischoff, 1865–7, Dr. Tiling, 1867.

Although long known and of late years fairly well distributed in collections, this Alaskan plant seems never to have been looked upon as different from the eastern *S. angustifolium* until recently distinguished by Professor Greene, as a matter of fact since the above description was penned. In other writings, as on specimen labels, the plant has been variously referred to as *S. angustifolium* under the names *S. anceps* Cav., *S. Bermudiana* var. *anceps* Gray and *S. mucronatum* Michx. The species is well distinguished from *S. angustifolium* being larger in every way, in fact, notwithstanding its boreal habitat the stoutest species of the simple-stemmed sec-

tion of the genus. It is not nearly so pale and glaucous as *S. angustifolium*, if at all so, and dries much darker; the leaves and stem are broader, the spathes and bracts larger and of a somewhat different shape, the flowers and especially the fruit larger, the seeds little larger but darker, more globose and more distinctly and narrowly umbilicate. *S. littorale* has perhaps its nearest relative in *S. Idahoense*, but is clearly separable by thinner and broader leaves and stem, smaller flowers and larger fruit.

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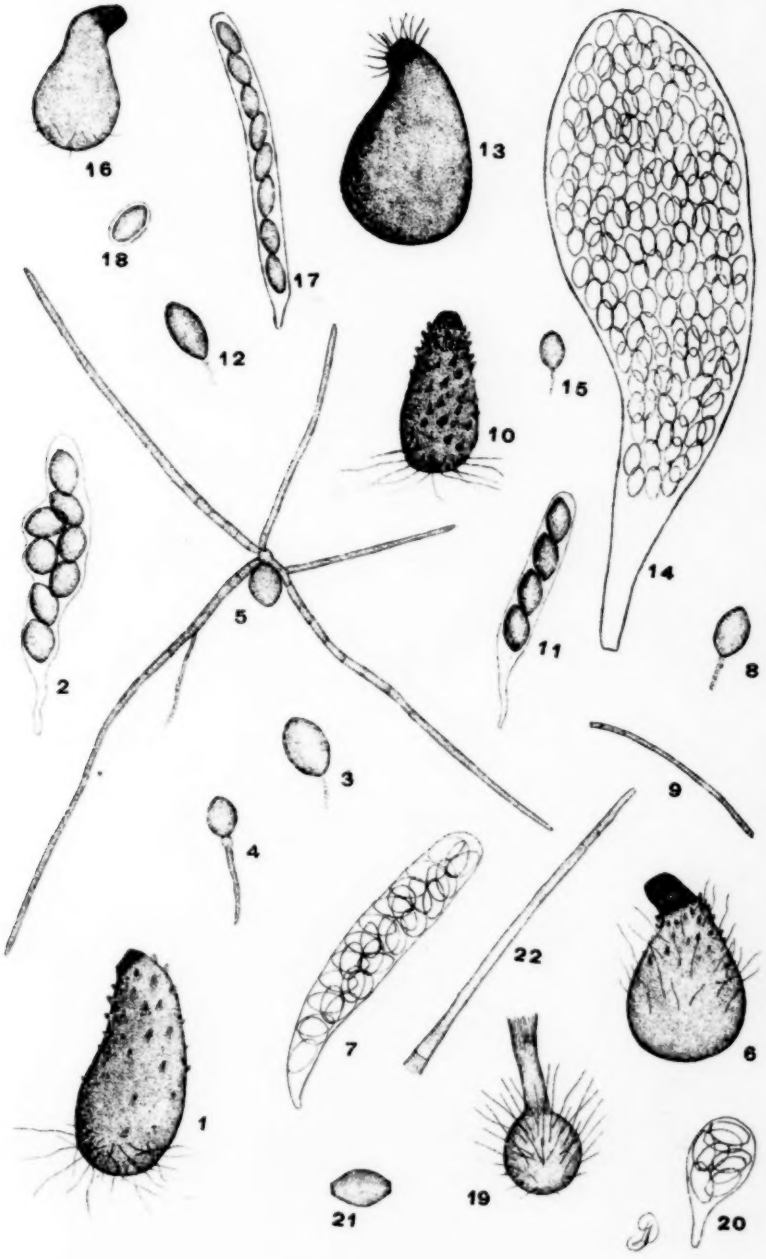

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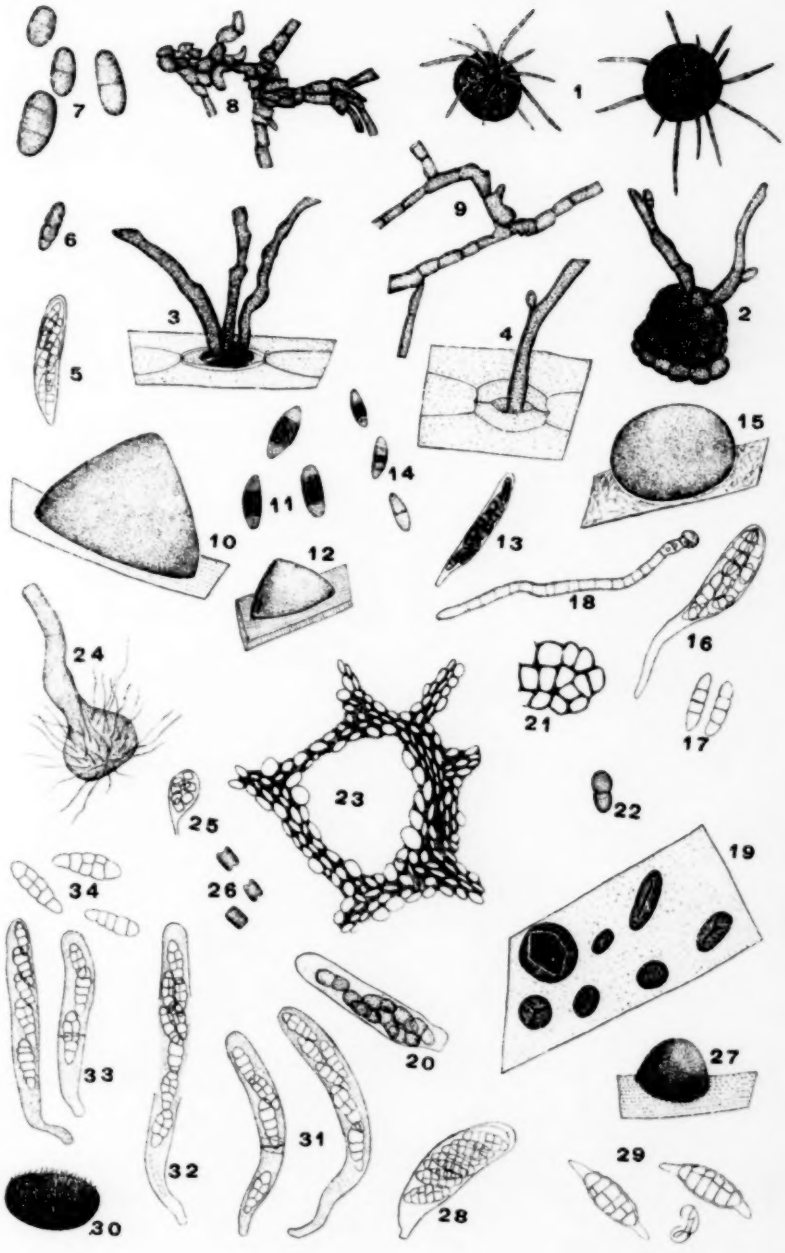

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